README- Regulatory Workgroup Members

The purpose of this agenda item is to brief the RG on the preliminary findings of the Science Panel re: science plan supporting the Biostimulatory-Biointegrity Project

This presentation is divided into two components:

1) Slides 2 – 6 represent an condensed version of the Panel's report out on April 20th, 2017
2) Slides 7 onward represent a "triaged" response of the Technical Team, intended to prioritize the issues that require interaction with the Water Board and advisory groups in order to address

Science Panel Responses to Charge Questions

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SCIENCE PANEL CHARGE QUESTIONS

1. Appropriateness and suggested refinements to the Biostimulatory-Biointegrity Science Plan (Sutula et al., 2017, Appendix1)

The Science Plan focuses on work needed to support policy decisions on a statewide set of "default" ASCI and CSCI assessment endpoints and numeric targets for nutrients et al. causal eutrophication indicators.

- Are refinements or additional elements to the Science Plan needed to improve scientific support for the Biostimulatory-Biointegrity Project and if so, what refinements?
- What specific refinements or elements would aid in directly addressing stakeholder concerns or issues?

2. Appropriateness and suggested refinements to the ASCI Work Plan (Theroux at al., 2016, Appendix 2)

The approach to develop the California algal stream condition index (ASCI; Theroux et al. 2016 ASCI work plan) follows that used for the California Stream Condition Index (CSCI; Mazor et al. 2016) for benthic macroinvertebrates.

- Is this approach described in Theroux et al. (2016; Appendix 2) appropriate for the ASCI? Are there additional refinements that you suggest that will improve on the proposed approach?
- Can biological indices or metrics be developed that distinguish between chemical, physical, hydrological and habitat impacts to biological integrity from altered water quality versus altered hydrological regime or physical habitat (substrate, cover, flow, etc.)?
- What are the tradeoffs in designing an index to be tuned to a generalized stressor gradient versus a specific gradient (e.g. water quality)?
- What are the tradeoffs in design of an index for statewide applicability versus application at a regional scale?

3. Statistical Models to Link CSCI and ASCI assessment endpoints to numeric targets for nutrients and organic matter abundance.

The Science Plan details a work element intended to support Water Board staff decisions on numeric targets for nutrients and organic matter by developing statistical stress-response models of the relationship between bioassessment indices (CSCI, ASCI) and concentrations of nutrients and organic matter abundance (benthic chl-a, ash-free dry mass).

- Given the exploratory analyses showing relationships between CSCI, ASCI and the eutrophication indicators of interest, what concerns should the technical team keep in mind when developing statistical stress-response models, and how might they be addressed?

1. Appropriateness and suggested refinements to the Biostimulatory-Biointegrity Science Plan (Sutula et al., 2017, Appendix 1)

- Can we look at multistressor indices to evaluate response of biological condition?
- Both N and P are potentially limiting; TN:TP ratios and likely limiting nutrient

- A stronger stressor response relationship that is focused on nutrients.
- Consider use of BCG for TALU

- Watershed vs. statewide approach - Watershed prioritization approach is described in EPA memo. What added value is sought by state board with regard to state defaults?
- Implementation - Distinguish between water column nutrient concentration limits, and loading limits. Current effort should focus on the former, but specifying load limits to achieve desired concentrations is a watershed-specific activity.
- Beneficial use tie in - Consider describing the loss of species (as expressed by O/E) values as a way to describe different thresholds to stakeholders, in addition to BCG narratives.

- The statistical models yield estimates of prediction uncertainty, which can be the basis for risk analysis.
- Consider additional work to provide survey and water quality data so that the ASCI and the CSCI can be statistically linked to beneficial use.
- Develop indices for beneficial uses; MMIs and O/E are good for aquatic life use
- Other metrics calculated from biological assessment could be used to indicate beneficial uses, e.g. recreational a - % macroalgal cover, % toxic cyanobacteria; recreational b? - % saprobic tolerant organisms – why not fecal bact cnts?

- Continue to think about different reference benchmarks for different regions that have different variation among metric scores. Re: different benchmarks, not clear how helpful it will be, but we will look at different population of reference sites and see whether the 10th percentile is very different.
- BCG not explicit, but too generalized to link to why a particular site is impaired. O/E gives a percent taxa loss. MMI – that value alone is difficult to interpret in ecological terms. Could build out narrative of what gets rolled into the MMI. BCG nice heuristic tool, but we can also borrow language.

2. Appropriateness and suggested refinements to the ASCI Work Plan (Theroux at al., 2016, Appendix 2)

- Use the multi-stressor metrics in differentiating physical, chemical, habitat, or hydrological impacts.

- Generally sound and based on methods used elsewhere, e.g. CSCI
- Keep in mind that you may not want to force yourself to use all the same methods, e.g. O/E
- In building the O/E, check data for taxonomic consistency.
- Reconsider use of stressor specific metrics

- Indices/Metrics that distinguish between types of stressors are the holy grail for biological assessment.
- This may be more possible in algae than invertebrates.
- This is really commonly done with algae, but these indices should not be in an IBI.

- It would limit the applicability of the index and may not be as sensitive to other stressors, but it would be highly sensitive to nutrients.
- An MMI based on generalized stressor gradient would probably respond strongly and satisfactorily to nutrients; Nutrients are a dominant factor along most human disturbance gradients.
- Consider use of a hierarchical modeling (empirical bayes) approach that combines the regional scale indices with the state wide index. This will result in regional indices with lower variance; the effect is greatest in regions with small datasets.

3. Statistical Models to Link CSCI and ASCI assessment endpoints to numeric targets for nutrients and organic matter abundance.

- Consider the use of composite indices for nutrients and/or adding additional time series of stressor data when available to explore relationships with CSCI and ASCI.
- Cold water versus warm water habitats may have very different nutrient responses – sensitivity analyses partial dependence analyses; we'd expect much more sensitivity to nutrients in warm than cold water systems—all things being equal.
- Consider analysis of deviation from reference for biological condition and nutrient concentrations.
- This is a good approach
- Consider causal analysis (structured equation modeling)
- Account for interactions with other factors and covarying factors
  - Is it N or P, or both
  - Consider RF and partial dependence plots
- Communicate results more clearly

Tech Team Response

Science Panel Recommendations Can Be Put into Four Categories:

- Need context from policy options in order to address
- Practical to implement; incorporate as priorities and resources allow
- Implement as part of a watershed approach (not applicable to a statewide approach)
- Other Advice—No immediate action

Need Policy Options as Context to Address

- Statistical Modeling:
  - The statistical models yield estimates of prediction uncertainty, which can be the basis for risk analysis.
  - Account for interactions with other factors and covarying factors; consider analyses of deviation from reference for organic matter and nutrient concentrations.
  - Consider analysis of deviation from reference for nutrient concentrations, e.g. an O/E approach
- BU Focus of Policy: Just ALUs, or Other BUs?
  - Consider additional work to provide survey/water quality data so that the indices can be statistically linked to beneficial use.
  - Other metrics calculated from bioassessment could be used to indicate beneficial uses (e.g. recreational a - % macroalgal cover)
- Basis for Decisions on Endpoints:
  - Continue to think about different reference benchmarks for different regions that have different variation among metric scores. Re: different benchmarks, not clear how helpful it will be, but we will look at different population of reference sites and see whether the 10^{th} percentile is very different.
  - BCG not explicit and is too generalized to link to why a particular site is impaired. O/E gives a percent taxa loss. MMI – that value alone is difficult to interpret in ecological terms. Could build out narrative of what gets rolled into the MMI.

Need Policy Options as Context to Address

- Channels in Developed Landscapes:
    - Goals for modified channel research should be clarified. Not clear on exactly we were trying to achieve. Actually trying to predict potential? Clarify your intended application. Modified channels may be need different approach.
- Consider seasonality – wet versus dry weather.

Practical to Implement—Incorporate as Resources Allows

- Statistical Modeling:
  - Account for interactions with other factors and covarying factors (Is it N or P, TN:TP)
  - Consider RF and partial dependence plots
- BCG: Beneficial use tie in - Consider describing the loss of species (as expressed by O/E) values as a way to describe different thresholds to stakeholders, in addition to BCG narratives.
- ASCI
  - Don't to force yourself to use all the same methods, e.g. O/E;
  - In building the O/E, check data for taxonomic consistency;
  - Reconsider use of stressor specific metrics;
  - Indices/Metrics that distinguish between types of stressors are the holy grail for biological assessment; stressor tuned indices may be more possible in algae than invertebrates; these indices should not be an IBI;
  - Stressor tuned indices would limit the applicability of the index and may not be as sensitive to other stressors, but it would be highly sensitive to nutrients.
  - An MMI based on generalized stressor gradient would probably respond strongly and satisfactorily to nutrients; Nutrients are a dominant factor along most human disturbance gradients.
  - Consider use of a hierarchical modeling (empirical bayes) approach that combines the regional scale indices with the state wide index. This will result in regional indices with lower variance; the effect is greatest in regions with small datasets.

Implement as a Part of A Watershed Approach

- Implementation - Distinguish between water column nutrient concentration limits, and loading limits. Current effort should focus on the former, but specifying load limits to achieve desired concentrations is a watershed-specific activity.
- Consider the use of composite indices for nutrients and/or adding additional time series of stressor data when available to explore relationships with CSCI and ASCI.
- Consider causal analysis (structured equation modeling)

Other Advice/Clarifications Sough- No Immediate Action

- Use the multi-stressor metrics in differentiating physical, chemical, habitat, or hydrological impacts. Functional attributes of system or summary indices of stressors may be better to help diagnose and manage the source of biological impairment.
- A stronger stressor response relationship that is focused on nutrients.
- Consider use of BCG for TALU.
- Implementation - Distinguish between water column nutrient concentration limits, and loading limits. Current effort should focus on the former, but specifying load limits to achieve desired concentrations is a watershed-specific activity.
- Watershed vs. statewide approach - Watershed prioritization approach is described in EPA Stoner memo. What added value is sought by state board with regard to state defaults?