

## **Review of Development of Benthic Macroinvertebrate and Algal Biological Condition Gradient Models for California Wadeable Streams, Paul et al. in prep.**

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A majority of the Science Advisory Panel decided to provide additional responses to the charge questions for the BCG project, which were:

- Comment on the adequacy of the statewide bioassessment data set and the analytical approaches to evaluate the range of natural variability and its interpretation in CSCI and ASCI.
- Comment on the adequacy of the data set, the analytical approaches, and findings of the development of a BCG model.
- Are there technical ways to address stakeholder concerns?

The panel recognizes that the BCG provides a narrative interpretation of bioassessment index scores, a feature that can facilitate communication with stakeholders. These narrative interpretations also have the potential to help define thresholds for management, but much more work is required to define and identify thresholds with the BCG and to understand better how regional differences within California affect BCG scores and interpretations.

With respect to the specific charge questions, the statewide bioassessment dataset and the analytical approaches to evaluate the range of natural variability and its interpretation in the CSCI and ASCI were adequate for use in the BCG project. The analytical approaches in the development of the BCG model are well accepted and were improved when used in California compared to previous projects elsewhere. The findings of the BCG effort were scientifically sound for the restricted application of the relationship described above and for a statewide generalization. Additional data and analyses would be needed to address some stakeholder concerns related to regionalization of models and defining tiers of biological condition based on expert opinion of BCG axis scores for sites. Many of the stakeholder concerns could be alleviated with a more thorough understanding of the BCG and expert scoring process, or their concerns may not be relevant if the results of this BCG project are limited simply to translation of statewide patterns in CSCI and ASCI scores.

A majority of the panel would also like to emphasize that a watershed condition index has limited use for developing tools for assessing biological condition and biostimulatory management targets. We support use of nutrient concentrations as primary management targets to protect beneficial uses, rather than a watershed condition index, an enrichment factor, or a pollutant load. As pointed out in the TR 871 report, an NRC panel concluded that a water quality criterion should be a variable in a causal set of relationships that is as close as possible to the designated use. In the case of eutrophication by algae, nutrient concentrations regulate algal physiology, growth rates, species composition, and biomass accumulation. Nutrient loads, along with many other factors, regulate nutrient concentrations, and only indirectly affect algae in the set of causal relationships. In addition, loads are heavily skewed toward large flows and have limited effect on nutrient exposure time, because algae are most exposed to baseflow nutrient conditions. Land use and enrichment factors, which partially regulate nutrient loads, are even farther yet from direct effects on algae in the causal pathway.