

## **Recommendations for the development and maintenance of a reference condition management program (RCMP) to support biological assessment of California's wadeable streams**

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### **EXECUTIVE SUMMARY**

Direct measures of the ecological condition of waterbodies have received a recent surge in interest within California's water quality management and regulatory programs because biology-based assessments have several advantages over chemistry- or toxicity- based assessments. Biological assessments are more closely linked to the beneficial uses to be protected and chemistry- or toxicity-based criteria usually lack the predictive ability to infer biological condition. Ultimately, California needs to develop biology-based standards, or biocriteria, as a regulatory tool for monitoring and protecting aquatic life use.

Biological assessment tools, including biocriteria, attempt to objectively "score" the biological integrity at a given site. A crucial component to the development of assessment tools is understanding biological expectations at reference sites that consist of natural, undisturbed systems. These reference systems set the biological condition benchmarks for comparisons to the site(s) being evaluated. Two recent external reviews of the State Water Board's Surface Water Ambient Monitoring Program (SWAMP) affirmed the importance of a sound statewide reference condition program (i.e., TetraTech 2002, SPARC 2006).

In October 2007, the SWAMP bioassessment committee assembled a technical panel of statewide and national experts in bioassessment. The panel met for three days to develop a set of recommendations that the SWAMP program could use to establish and maintain a comprehensive reference condition management program (RCMP). The program accounts for biological variation caused by natural environmental gradients and balances statewide consistency with the flexibility needed to adapt to California's diverse regional settings. Furthermore, the plan allows for adaptive refinement over time.

The panel defined a general strategy for establishing the RCMP that has four components:

1. California will be divided into different geographic regions based on coarse biogeographic similarities in order to partition some of the natural variability among regions (these boundaries should be consistent with those used for the SWAMP Perennial Streams Assessment)
2. A pool of reference sites will be assembled within each region through a sequential process of identification and screening of candidate sites
3. The sites within each reference pool will be managed through iterative review of data to refine regional boundaries, ensure continued suitability of sites and ensure adequate representation of natural gradients
4. A monitoring design will be created for sampling this pool of reference sites to document the range of biological and physical condition at reference sites, and monitor for changes to this condition over time

The panel recommended identifying and screening candidate locations to create a pool of verified reference sites using either a “standard model” or an “alternative model”. The standard model will cover the vast majority of the state where high quality sites are available. The alternate model will apply in those regions where an insufficient quantity of high quality sites exist and another strategy is required for selecting candidates for the reference pool. This may include regions such as the agriculturally dominated Central Valley or the intensely urbanized southern California coastal plain.

The standard model is a synthesis of widely used techniques for selection and screening candidate sites using a toolbox consisting of existing site data, GIS techniques, expert knowledge and site visits. The alternative approach consists of two general strategies: 1) modification of standard tools (e.g., lowering the GIS screening thresholds, collecting more intensive site data) and 2) use of non-standard approaches. The non-standard approaches include:

- Select best sites using existing biological indices
- Species pool approach
- Factor-ceiling approach
- Model taxon preferences for limiting environmental gradients

These different approaches are not mutually exclusive and several panel members recommended they be used in combination to provide weight-of-evidence that candidate sites are acceptable for the reference pool in these difficult locations.

The panel outlined a monitoring strategy for the RCMP, which included recommendations for sampling methods, sampling density and frequency, and the set of biological, chemical and physical attributes that should be collected at each reference site. The panel strongly recommended that the RCMP should be compatible with ongoing statewide monitoring programs such as the newly developed SWAMP Perennial Streams Assessment. For the monitoring design, the panel recommended both random and targeted sites. A probabilistic rotating panel was suggested for the random design because it provides an unbiased method for defining natural variability while still optimizing large-scale trend detection. Targeted repeated sampling designs are useful for detecting trends at specific locations; some of these sites have been sampled for years and provide a rich history that should not be lost.

To guide the SWAMP program as it implements the RCMP, the panel made a series of recommendations for prioritizing the elements of the plan. The panel recommended that the implementation begin by screening existing datasets for reference sites, followed by a combination of GIS screens and site visits to fill in gaps in regions with few reference sites.

## **Full Text**

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