SWAMP
Surface Water Ambient Monitoring Program

Management Memo | Condition

STATUS OF CALIFORNIA'S WADEABLE PERENNIAL STREAMS (2000 -2007)

The Surface Water Ambient Monitoring Program's (SWAMP) Perennial Streams Assessment (PSA) surveys measure the ability of California's perennial wadeable streams (some 85,000 km) to support aquatic life. PSA surveys found half (50%) of the wadeable perennial stream length in California to be in relatively good biological condition, while about 22% is in very degraded biological condition. The statewide distribution of good, degraded and very degraded sites shows that most high quality streams in good biological condition are located in the mountainous regions of the state. Streams with the most degraded biology tend to be found in low lying agricultural and urban areas in the central valley and parts of the coast (Figure 1).

OBJECTIVE

The objective of this memo is to inform management on the condition of California's wadeable perennial streams and their ability to support aquatic life beneficial uses.

The condition of California's streams has been very consistent over the eight year period tracked by the PSA (2000-2007). These long-term assessments are designed to detect trends, changes in biological condition over time. They are based on benthic macroinvertebrate assemblages (i.e., insects and other bottom-dwelling invertebrates) found at sampled sites and compared with assemblages at relevant reference sites. These benthic macroinvertebrates are the focus of the State's new biological objectives initiative.

CALIFORNIA NPS PROGRAM

CALIFORNIA Water Boards

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The biological condition of streams varied considerably among the areas defined as PSA regions (Figure 2). In the heavily forested regions (North Coast and Sierra Nevada) 70% of the streams length was in good condition. About a third of streams in the Chaparral region were in good condition. None of the streams in the Central Valley were in good biological condition. Streams in the South Coast region were in much better condition than might be expected, given the region's high degree of development. This may be a reflection of the high proportion of stream length in higher elevation streams which tend to drain less developed areas and still support intact biological communities.

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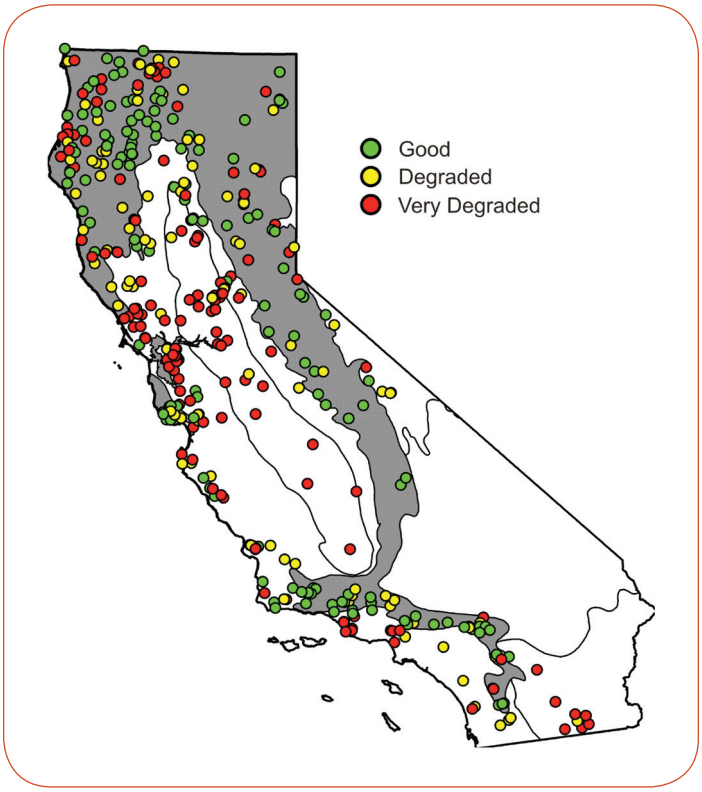


Figure 1. Distribution of 400 PSA survey sites, coded by biological condition (Green = good biological condition, Yellow = degraded biological condition, Red = very degraded biological condition). Gray areas indicate mountainous regions; white areas indicate dry xeric regions.

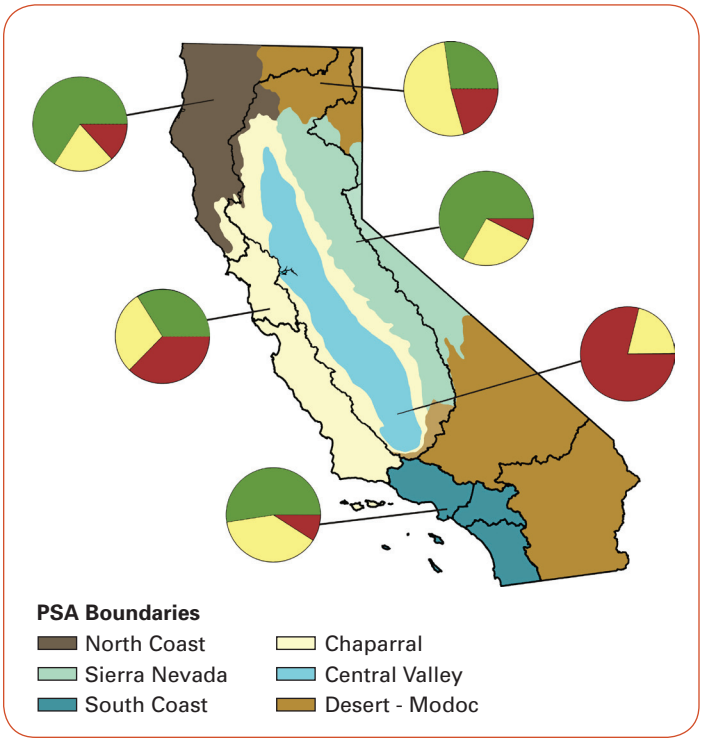


Figure 2. Condition of aquatic life in streams draining the six PSA regions. Pie charts indicate the relative proportions of streams in good biological condition (green), degraded biological condition (yellow) and very degraded biological condition (red). Color overlays of PSA Regions are presented on the map. Black lines correspond to underlying Regional Water Board boundaries.

Prevalence of Common Water Quality Factors

Chemical and physical indicators measured by the PSA are valuable in assessing the general water quality and habitat condition of wadeable perennial streams. These include: phosphorus, nitrogen, chloride, conductance, turbidity, suspended solids, bed stability, instream habitat, riparian vegetation, and riparian disturbance. The probabilistic design of the PSA surveys produces objective estimates of the prevalence of these indicators in California streams. Figure 3 compares the levels of these indicators to thresholds for moderate and severe impairment.

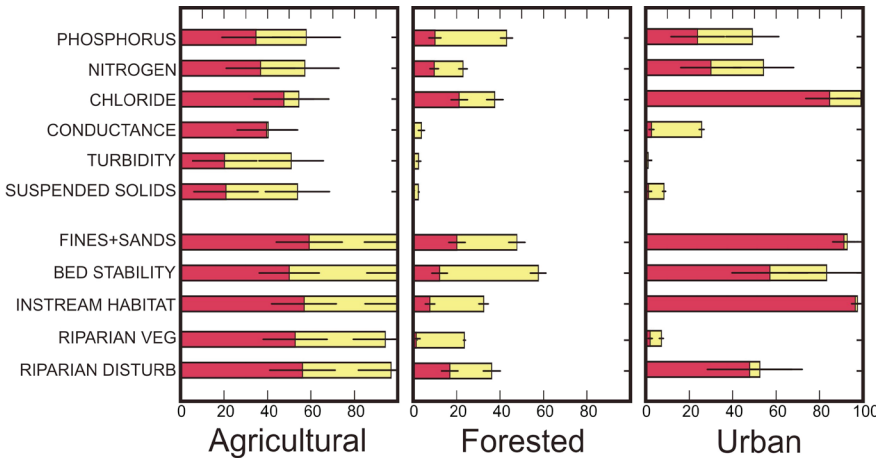


Figure 3. Percentage of streams draining agricultural, forested, and urban landscapes that exceed severe (red) and moderate (red + yellow) degredation thresholds for water quality factors. Threshold values, which trigger water quality to be categorized as degraded or very degraded, are detailed in the 8-Yr Report, Table A-3 (Ode et. al. 2011).

Nutrients (nitrogen and phosphorous) affected a large proportion of California's wadeable perennial streams, exceeding moderate degradation thresholds along approximately 40% of the stream length. Chloride levels were another common stressor, affecting greater than 50% of stream length at moderate levels. In contrast, turbidity and suspended solids were only rarely found in exceedance of the EPA thresholds.

The moderate thresholds for instream habitat degradation (% fine sediment and bed stability) were exceeded in 40-65% of California's streams. Riparian disturbances also were common (40% of streams exceed moderate thresholds). Riparian vegetative complexity was impaired less often than the other habitat measures (only 25% of streams exceeded moderate thresholds).

Conditions by Land Use

To assess the condition of streams draining different types of land use, PSA sites were assigned to one of four classes based on the dominant land use in the upstream watershed (see Ode et al. 2011 for details). Land use appears to be a strong determinant of stream condition (Figures 3 and 4). Nearly all the streams in urban and agricultural watersheds are in poor biological condition.

Streams draining agricultural areas tended to have high nutrient levels, chloride levels and conductance. In addition, almost all of these streams exhibited some form of habitat disturbance, both instream and riparian. Urban streams had high levels of nutrients and very high levels of chloride. Habitat degradation was common in most urban streams where instream habitat was especially degraded. Poor water quality and habitat degradation observed in forested areas was less pervasive than for either agricultural or urban areas. Although the PSA was not designed to determine cause and effect, there are clear and strong associations between habitat quality and biological condition (see Ode et al. 2011 for more detail).

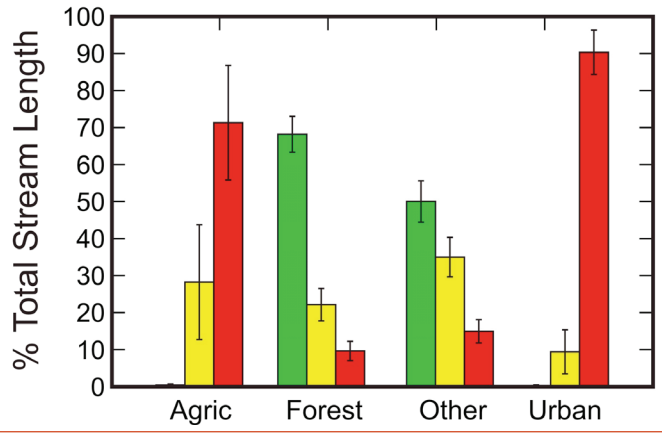


Figure 4. The percentage of stream length draining agricultural, forested, urban, and other (mixed) landscapes that are in good (green), degraded (yellow) and very degraded (red) condition.

Recommendations for Management:

- The State should continue statewide monitoring and assessment of streams. The biological assessment tools developed by the SWAMP Bioassessment Monitoring Program provide background and context on the biological condition of wadeable perennial streams throughout the State. These efforts continue to form the foundation for statewide 305(b) assessments. This is key to the Water Boards' ability to measure the performance and success of its restoration and protection programs and should be used as a foundation for prioritizing monitoring, remediation and protection efforts. The development of additional indicators of stream health including algal indices and riparian measures will provide State regulatory agencies with additional diagnostic tools to shed light on the cause(s) of impairment and evaluate effectiveness of management activities. The development of biological assessment tools should be expanded to non-perennial streams which represent approximately 66% of the State's stream length (see Management Memo – Extent of California's Perennial and Non-perennial Streams).

The development of biological objectives will lead to greater consistency in the use and interpretation of biological data. These condition surveys provide context to regulatory programs

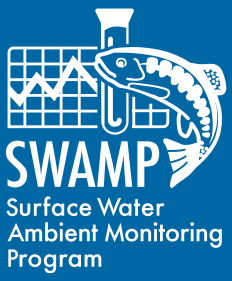
- The Water Boards need additional regulatory tools to protect streams. Most of the stream degradation identified by the PSA appears to be related to water quality factors and habitat quality issues that are not addressed well by traditional water quality programs. Elements of the Wetlands and Riparian Area Protection Policy currently under development, including the definition of water quality objectives for riparian areas, will be instrumental to protecting stream health. The development of biological objectives will provide programs with a quantitative regulatory tool to protect stream resources. Benthic macroinvertebrate assemblages are a tool the State can use to identify high quality waters deserving of further protection as part of the Antidegradation Policy. Roughly half of the state's perennial wadeable streams are in good biological condition.

- Biological monitoring and assessment should be integrated into Water Board programs. Water Board programs already implementing bioassessment tools include: Storm Water (e.g., construction general permit), TMDL, and NPDES permitting. Other Water Board programs which would find value and benefit from application of bioassessment tools include: Non-Point Source Program, Water Quality Certification and Wetlands Program, Irrigated Lands Regulatory Program, and many Regional Board programs. The development of biological objectives will lead to greater consistency in the use and interpretation of biological data. These condition surveys provide context to regulatory programs (See Management Memo – Value of SWAMP's Statewide Monitoring Programs).

- The California Water Quality Monitoring Council should use the PSA surveys and bioassessment tools to foster collaboration among other State and Federal agencies with common monitoring goals.

References

Ode, P.R., T.M. Kincaid, T. Fleming, and A.C. Rehn. 2011. ***Ecological Condition Assessments of California's Perennial Wadeable Streams****: Highlights from the Surface Water Ambient Monitoring Program's Perennial Streams Assessment (PSA) (2000-2007).*



For more information, please contact:

SWAMP Program Coordinator
State Water Resources Control Board
Office of Information Management and Analysis
1001 I Street, 15th Floor
Sacramento, CA 95814
(916) 341-5556