Demonstration Project to Test a New Interdisciplinary Approach to Rehabilitating Salmon Spawning Habitat in the Central Valley

Spring 2004

This was the seventh quarter of this CALFED project to demonstrate the utility of the Spawning Habitat Integrated Design Approach (SHIRA). In the previous quarter, the primary work performed was data analysis, writing up findings, and presenting information to the public and partner groups. During this quarter, work continued to emphasize data analysis and report writing. An important goal for this quarter was to reduce the quantifiable uncertainty in the use of 2D models for predicting hydrodynamic, sediment scour, and habitat quality predictions.

There were four types of data analysis worked on this quarter. The first topic of interest was continuing to develop, test, and evaluate tools for use in preparing a gravel-augmentation sediment budget for the Lower Mokelumne River. We have been using theoretical equations, our own DEM differencing analyses, and historical cross-section re-surveys to evaluate how much gravel is needed to maintain the available habitat. The work has been addressing the baseline 1999 and 2000 gravel augmentation projects done by EBMUD and the joint EBMUD-UCD 2001 SHIRA demonstration project. An important result we have found is that ~50% of the volumetric change to a gravel placement site is due to in situ gravel repacking. No one has reported this effect before. The full gravel placement sediment budgets for these sites are reported in a Ph.D. thesis completed this quarter. We have drafted a scientific article based on this work, but are still editing it in preparation for submission to a peer-reviewed journal.

The second topic of interest has been assessing the quantifiable uncertainty in using 2D models to predict the spatial pattern of depth, velocity, and bed shear stress for gravel placement sites. Because both depth and velocity predictions are used in shear stress predictions, it is necessary to determine the effect of error propagation from those independent variables to the dependent variable. These analyses were completed during the quarter and a scientific article has been drafted for submission to a peer-reviewed journal. One key finding is that error in topographic interpolation from field surveys is the single largest source of error in the 2D model predictions. Survey point density needs to be increased to >1 point per m^2 to reduce this source of error and breaklines should be surveyed wherever possible to help delineate boulders and other sharp channel bed features. A second important result of the work is that 56% of shear stress predictions were within the 95% confidence limit of field-measured estimates. Poor predictions occurred along banks and over other very shallow (<20-cm depth) areas.

The third topic of interest has been assessing the quantifiable uncertainty in using 2D models to predict the spatial pattern of chinook spawning habitat. Once again, errors in topographic interpolation represent the largest source of error in habitat quality prediction using a 2D model. This problem is solvable with a higher density of point measurement and with the addition of breaklines in digital elevation models. Since this problem does not affect user-designed elevation models, this problem only affects pre and post project assessment, not design development. Even with this source of error, 95% of the redds observed on the 2002 gravel placement site in the months after construction were at locations predicted by the 2D model to be good or best quality. Only 3 redds occurred in poor quality locations, and those were in the vicinity of habitat heterogeneity elements.

The fourth topic of interest has been assessing the uncertainty in the habitat suitability curves for the Lower Mokelumne River. With EBMUD's help, we have compiled and analyzed

all of the data on observed redds in the system from 1994-2003. We have generated new sets of habitat suitability curves using different subsets of this dataset and compared them against each other and against CDFG curves from 1980s data. We are also constraining the delineations between different habitat qualities by comparing curves to 2D model predictions and actual redd observation at recent gravel placement sites.

All in all, these data-rich studies have provided significant experiment results constraining the uncertainty in using 2D models for designing and monitoring gravel placement projects in the Central Valley. In the next quarter we will continue to write up these findings for peer review and present them at scientific meetings and workshops, while also conducting the pre-project and design development phases of the 2004 SHIRA demonstration project.