Ten-Year Summary of the Monterey Peninsula Water Management District's Bioassessment Program on the Carmel River

Prepared For:
Monterey Peninsula Water Management District

Prepared By:
J. Thomas King
BIOASSESSMENT SERVICES
Folsom, CA

In Association With:
Beverly Chaney – Associate Fisheries Biologist
Thomas Lindberg – Associate Hydrologist
MONTEREY PENINSULA WATER MANAGEMENT DISTRICT
Monterey, CA

November 2010

SUMMARY

The Monterey Peninsula Water Management District (District) initiated a monitoring program in the fall of 2000 to help evaluate the water quality and physical habitat conditions of the Carmel River and to establish baseline information that may be used in conjunction with other water quality programs to assess potential effects of future land and water use activities. District staff recognized that monitoring of aquatic benthic macroinvertebrates (BMI) could supplement and complement their ongoing surface water quality sampling program and fisheries management efforts.

The monitoring was conducted using protocols outlined in the California Stream Bioassessment Procedure (CSBP), which is a standardized procedure for characterizing BMI assemblages inhabiting riffle habitat in wadeable streams. Because of BMI abundance, taxonomic diversity and range of response to changes in their aquatic environment, they are commonly used to monitor the quality of surface water resources.

In the fall of 2000, four monitoring sites were established on the Carmel River between Mid-Carmel Valley and below Los Padres Dam. Sampling was continued twice per year in the spring and fall seasons through fall of 2003. In 2002, an additional site was established at the Russell Wells to better evaluate effects of future sediment releases from San Clemente Reservoir. This site was later dropped. In 2004, sampling was restricted to the fall season and a reference site was established above Los Padres Reservoir. An alternative site, Scarlett Well, was sampled on two occasions when low flow conditions prevented sampling at the Red Rock site.

From 2000 to 2003, benthic samples collected from the sites were processed in the laboratory by identifying a random subsample of 300 BMIs from the three samples collected at each site. From 2004 to 2009 the three samples collected at each site were composited and 500 organisms were subsampled. Subsampled organisms were identified to a standard taxonomic level. BMI data prior to 2004 were standardized to 500 organism subsamples and current standard taxonomic effort so that exploratory data analyses could be conducted on the 10-year data set. Biological metrics were used to describe characteristics of the BMI assemblages and a composite of seven metrics was used to generate a regional index of biotic integrity (IBI) to assess site quality as a function of the BMI assemblages that inhabited the sites. In addition, ordination was used to evaluate relative sample similarity as a function of BMI taxonomic composition and to identify relationships between biological and environmental variables.

Carmel River BMI monitoring over the 10-year program period indicated strong and consistent effects of the dam/reservoir systems on downstream BMI assemblage quality as depicted by IBI values with some improvement with increasing distance downstream of the reservoirs. Published literature sources list multiple effects of dam/reservoir systems on downstream benthic fauna, which include altering fluvial processes, allochthonous material transport, flow, water temperature and food supplies. While inconclusive, several factors assessed during the Carmel River Bioassessment Program likely contributed to lowered BMI assemblage quality downstream of the reservoirs. These factors included elevated water temperature downstream of the reservoirs when compared to the upstream reference site and slightly higher average substrate size at sites immediately downstream of the reservoirs. Annual hydrographic data indicated a mostly seasonal pattern of flow through the sites, indicating that the dams do not appreciably alter seasonal flow patterns. Other

causative factors identified in the literature were either not assessed or not adequately quantified due to the constraints of the monitoring procedure. Consequently, alternative monitoring approaches or targeted studies would need to be adopted to gain a clearer understanding of all the factors contributing to compromised BMI assemblages downstream of the reservoirs.

Urbanization effects on Carmel River BMI assemblage quality were of less magnitude when compared to reservoir effects. While periodic accumulations of both natural and anthropogenic organic material have been documented at the lowest elevation Carmel River monitoring site, the level of organic material did not preclude the presence of sensitive BMI taxa, nor did it compromise abundance. Conversely, the lowest elevation monitoring site had the highest BMI abundance and biovolume of all sites probably because of seasonal accumulations of organic matter. Reservoir systems sequester allochthonous organic matter, which may be one factor compromising BMI assemblage quality at sites immediately downstream of the project reservoirs. But reservoir systems can also augment downstream BMI food supplies with plankton as appeared to be the case downstream of Los Padres Reservoir where BMI abundance and biovolume were higher than the upstream reference site.

There were downward trends in BMI assemblage quality over the 10-year monitoring period at two successive sites downstream of San Clemente Reservoir, possibly in response to annual drawdowns of the reservoir. There were no upward or downward trends in BMI assemblage quality at the other sites throughout the monitoring period. However, there was a large magnitude decline in BMI assemblage quality at the reference site in 2007 during a critically dry water year. Full recovery occurred the following years despite the Basin Complex Fire in the Los Padres Wilderness, which occurred in the summer of 2008. The Sleepy Hollow Steelhead Rearing Facility's rearing channel had similar BMI assemblage quality compared to the two sites immediately downstream of the reservoirs. While there were seasonal influences on BMI taxonomic composition, index of biotic integrity values were minimally affected by season. This result is important with regard to future program planning because it allows some flexibility in the sampling window. A late spring or early summer sampling window is being recommended for central coast bioassessment projects.

A published literature source indicated that the dominant BMI taxa sampled from the Carmel River provide readily available food resources for salmonid populations. These taxa include baetid mayflies, black flies, and midges.

Instream and riparian habitat quality at the monitoring sites were generally good as determined by qualitative assessments outlined in the monitoring procedure. Instantaneous water quality constituents (temperature, pH, dissolved oxygen and specific conductance) measured during the monitoring period fell within ranges typical for the region.