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## Objective

This pilot project of the California Department of Pesticide Regulation, Surface Water Protection Program was designed to establish baseline aquatic biological community structure and physical habitat conditions in select wadeable streams within the California central valley. A secondary objective was to evaluate parameter differences if possible, between site types and seasons.

## Study Plan

Four creeks were selected: Two urban (UB) dominated creeks in Sacramento County, CA; and two agriculture (AG) dominated creeks in San Joaquin County, CA. Monitoring was conducted fall 2002 through spring 2004.

- Physical habitat assessments were completed for each reach, along with the collection and analysis of water, sediment and benthic macroinvertebrates (BMI). Water samples were analyzed for selected organophosphates, pyrethroids, and triazines, and sediment samples were analyzed for pyrethroids. BMIs were summarized into biological metrics.
- Physical habitat assessments and BMI sampling followed DPR SOP #FSWA010.00, Instructions for Sampling Benthic Macroinvertebrates in Wadeable Waters Using the Multi-habitat Method (modified U.S. EPA method) during year one, and DPR SOP #FSWA015.00, Instructions for sampling benthic macroinvertebrates in wadeable waters using the Modified U.S. EPA EMAP method during year two.
- Multivariate analysis of biological metrics indicated no significant difference in sampling methods ( $p=0.281$ )

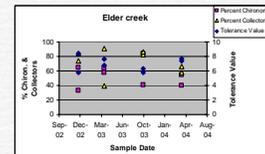
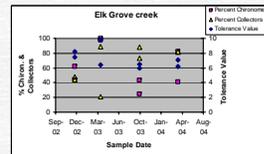


Lone Tree Creek

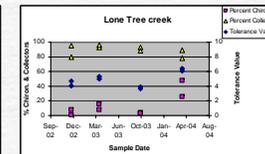
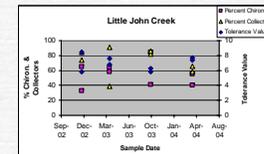


Elk Grove Creek

## URBAN CREEKS



## AGRICULTURAL CREEKS



## Results

### Water quality parameters:

**Temperature:** Similar in both UB and AG sites, and within normal ranges (<35°C) for BMIs over the two-year period. Temperature fluctuations beyond normal levels can have an effect on growth, fecundity, hatching success and adult emergence (premature or delayed).

**pH:** Levels dropped below normal ranges 13% and 7% of the time for UB and AG sites respectively, though never dropping below 5.5.

**SpC:** Exceeded 500 µs/cm 6% and 19% of the time at AG and UB sites, respectively. Recent studies indicate that SpC could be an important parameter affecting the composition of macroinvertebrate communities.

**DO:** UB sites fell below the accepted minimum in 44% of the sampling events, while AG sites fell below normal 15%. DO levels at 4mg/L or less are toxic to many species of invertebrates (U.S. EPA, 1986).

**Turbidity:** Did not exceed normal ranges at AG or UB sites.

T-tests indicated no significant difference between AG and UB sites in temperature, pH or turbidity measurements, but indicated a significant difference in DO ( $P=0.043$ ) and SpC ( $P=0.001$ ) measurements. With the exception of turbidity, seasonal variation indicated no difference between AG and UB sites for fall and spring water quality parameters.

**Physical habitat scores:** Physical habitat scores can range from 0 to 200, with 0 being the most impacted by anthropogenic activities and 200 being the least impacted. Though these scores are informative, they can be subjective due to the background and experience of the assessors. Physical habitat scores ranged from 37-124, with the highest score found at one agricultural creek. There was no significant difference between the two types of sites (t-test,  $P=0.29$ ).

**Pesticide detections:** There were numerous detections of diazinon and chlorpyrifos detected at all sites, ranging from trace to 0.212ppb and trace to 0.163ppb, respectively. Diuron was also detected at all sites with concentrations ranging from 0.063 ppb to 14.24 ppb. Pyrethroids were only detected in the urban creeks and consisted of three detections of bifenthrin in water (trace to 27.5ppt) and one trace detection of permethrin in sediment.

**Benthic Macroinvertebrates:** BMI metrics indicated the dominant taxa found at all sites were of the chironomidae and oligochaeta families. Chironomids occur in most aquatic ecosystems, tolerating a wide range of conditions. Oligochaeta are aquatic worms that can tolerate low levels of oxygen and are generally found in large numbers in organically polluted habitats. There were no hydrophyichidae and baetidae represented 5% or less of the total abundance of BMIs. Ephemeroptera, plecoptera and trichoptera (EPT) were only found at one of the four UB sites and families never exceeded two during the two-year study. EPT taxa were found at each AG site, but not consistently over the length of the study. On each occasion taxa consisted of 1 to 3 families, with the exception of one time when 6 families were found. BMI metrics did indicate a significant difference between the two types of sites ( $P=0.002$ ) and seasons ( $P=0.036$ ).

Of the functional feeding groups *collector-gatherers* were dominant at all sites. Significant numbers of *collector-filterers* were also present at one UB and one AG creek (34% and 45%, respectively). No more than 5% of the population were *scrapers* at the AG sites, while UB sites had up to 36% scrapers. Small numbers of *shredders* were found at one UB creek (3%) and one AG creek (1%) creeks. None were detected at the other two creeks. This may be an indicative of low amounts of coarse leaf litter. This is reflected in the low physical habitat scores (low bank and riparian vegetation). One UB creek and AG creek also had high numbers of *predators* (75% and 56%, respectively).

## Conclusion

Both creeks appear to have stressed environments:

- Urban creeks have higher *tolerance values* than agricultural creeks indicating more pollution tolerant individuals. (*Tolerance Values* represent BMI community tolerance to organic pollution, and were obtained from CA Dept. of Fish & Game, CAMLnet, 2003.)
- The high number of BMIs in the chironomidae family found at all sites, relative to baetidae and hydrophyichidae families, are indicative of a stressed environment.
- The imbalance of functional feeding groups found at all sites also reflects a stressed environment.

## References:

CAMLnet. 2003. List of California macroinvertebrate taxa and standard taxonomic effort [Online]. Available at <http://www.dfg.ca.gov/cabw/front%20page/CAMLnetSTE.pdf> (verified 23 Feb. 2004)

U.S. EPA. 1986. Ambient water quality criteria for dissolved oxygen. Report no. 440/5-86-003. [Online] Available at <http://www.epa.gov/cgi-bin/clarify>