

SCVURPPP Watershed Monitoring and Assessment Program

2002-2007 Monitoring and Assessment Summary & Sediment Quality Triad Pilot Study



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Managing Scientist

Presentation Outline

- Multi-Year Monitoring Plan Overview
- Results and Conclusions of 2002-2007 Monitoring
- Results of SQT Pilot Study
- Planned Monitoring Activities for FY 07-08

Multi-Year Monitoring Plan

Multi-Year Receiving Waters Monitoring Plan

- NPDES Permit Provisions C.7(a) and (b)
- FY 02-03 through FY 09-10
- Multi-Year Plan Revised March 1, 2004

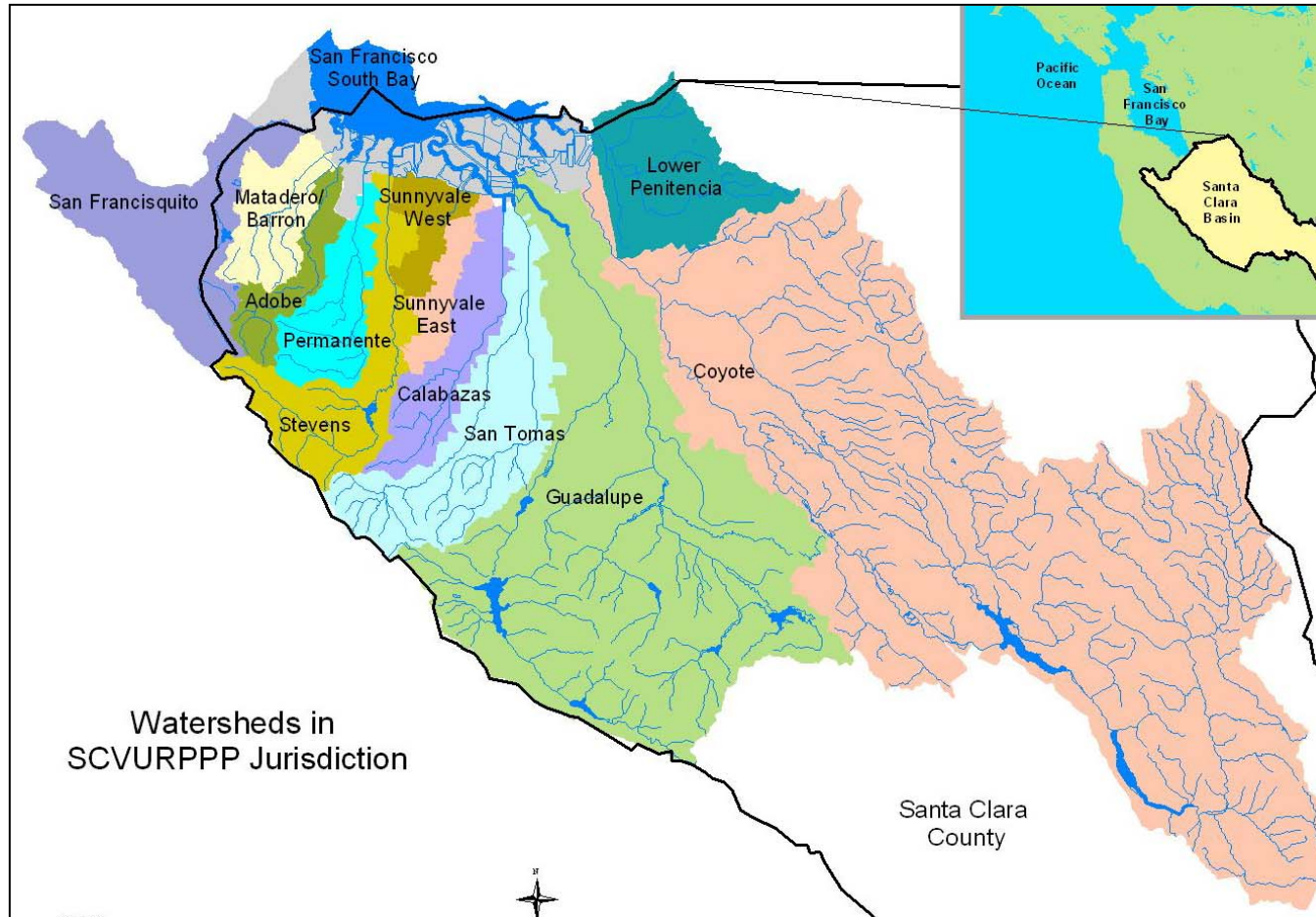


Monitoring Approach

- Adapted from Water Board's SWAMP
- Systematic process designed to assist Program in prioritization of studies/management actions
- Based on an indicators approach
- Monitoring levels include:
 - **Tier One** (Screening/Baseline)
 - **Watershed Assessment** (Data Analysis/Problem Id)
 - **Tier Two** (Investigative/Pollutant Specific)

Watershed Monitoring and Assessment Summary 2002-2007

SCVURPPP Watersheds

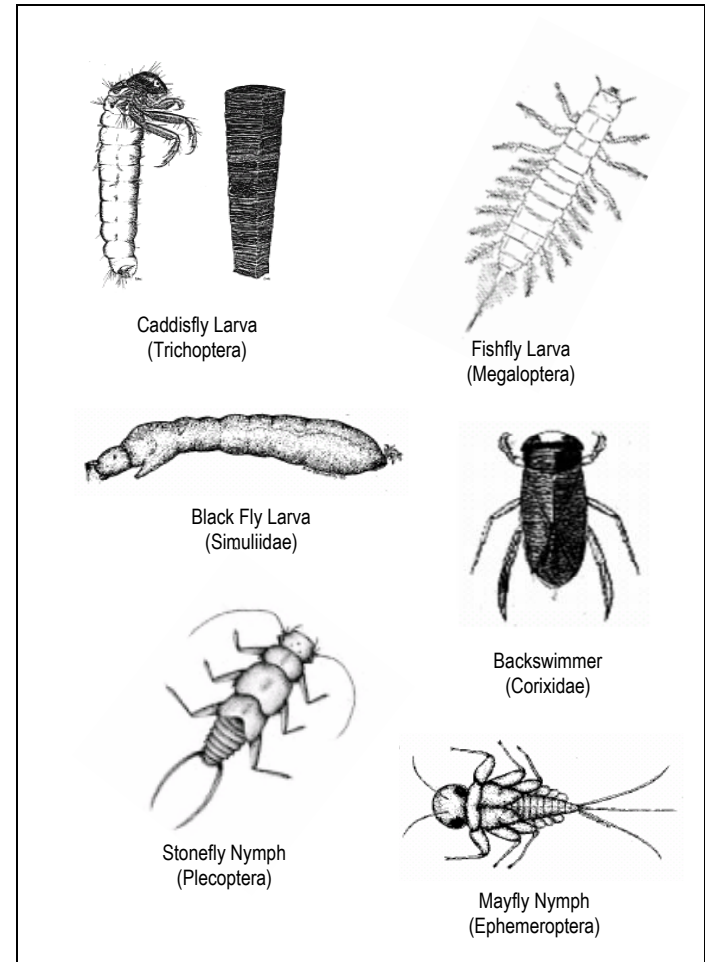


Indicators and Parameters

Indicator	Parameter Measured
<i>Aquatic Life</i>	
Physio-chemical	Water temperature, DO, pH, conductivity, stream velocity
Chemical	Total and dissolved metals
	Nutrients and anions
	Organic compounds (e.g., pesticides, PCBs, PAHs)
	Suspended sediment concentration
Aquatic Toxicity	3 species bioassays
Rapid Bioassessments	Benthic macroinvertebrates and fish community assemblage
Physical Habitat	Visual physical habitat assessment
<i>Recreational Use</i>	
Microorganisms	Total and fecal coliform, <i>Enterococcus</i> , <i>E coli</i>

Benthic Macroinvertebrates (BMIs)

- Include insect larvae, mollusks and worms.
- Essential link in the aquatic food web, providing food for fish and consuming algae and aquatic vegetation.
- Sensitive to disturbances in water and sediment chemistry, and physical habitat, both in the stream channel and along the riparian zone.



Monitoring Type, Frequency and Interval

- **Watersheds Sampled for Two Consecutive Years**
- **Rapid Bioassessments**
 - Fish sampling in non-anadromous creeks (Fall)
 - BMI sampling and visual habitat assessment (Spring)
- **Water Quality**
 - Two sampling events- represent different hydrologic conditions:
 - ⇒ Dry Weather Season (Summer/Early Fall)
 - ⇒ Wet Weather Season (Winter)
- **Aquatic Toxicity**
 - Dry and Wet Season
 - 3 species chronic (acute and chronic endpoints)
- **Note:** All samples are typically collected during non-storm events

Data Analysis/Interpretation

- **Water Quality Data**
 - Numeric Water Quality Objectives/Standards
 - EPA Recommended Criteria (Nutrients)
 - TMDL Targets (Diazinon)
- **Sediment Quality Data** – Probable Effects Concentrations
- **Aquatic Toxicity** – Significant Acute or Chronic Toxicity
- **BMI Communities** – Draft Preliminary B-IBI for Santa Clara Basin Creeks

Preliminary Benthic Index of Biotic Integrity (B-IBI) for Santa Clara Basin Creeks

- Reduce complex information about biological community structure into a simple numerical value (i.e., scores) that is indicative of aquatic life use condition.
- Based on multiple types of BMI information (i.e., metrics)
- Uses site conditions deemed as “reference” to scale scores for all sites
 - Few sites in natural condition in lower watershed sites
 - Therefore, initial development assumes relatively minor differences between BMI communities at sites under natural conditions
 - SF Bay B-IBI and future Statewide work will test this assumption
- Total B-IBI Scores for Santa Clara can range from 0-50 (50 being the best)

B-IBI Scoring Table

IBI Score	EPT Taxa	% Non-Insecta Taxa	# Diptera Taxa	# Predator Taxa	% Collectors
10	≥21	0 - 11	>10	≥12	0 - 48
9	19-20	12 - 19	10	11	49 - 54
8	17-18	20 - 26	9	10	55 - 60
7	15-16	27 - 32	8	9	61 - 66
6	13-14	33 - 39	7	8	67 - 72
5	11-12	40 - 46	6	7	73 - 78
4	9-10	47 - 53	5	6	79 - 84
3	7-8	54 - 60	4	5	85 - 90
2	5-6	61 - 67	3	4	91 - 96
1	3-4	68 - 74	2	3	97 - 99
0	≤2	75 -100	<2	≤2	100
B-IBI Scoring Categories					
Very Good	Good	Fair	Marginal	Poor	
50-46	45-40	39-26	25-13	12-0	

Results

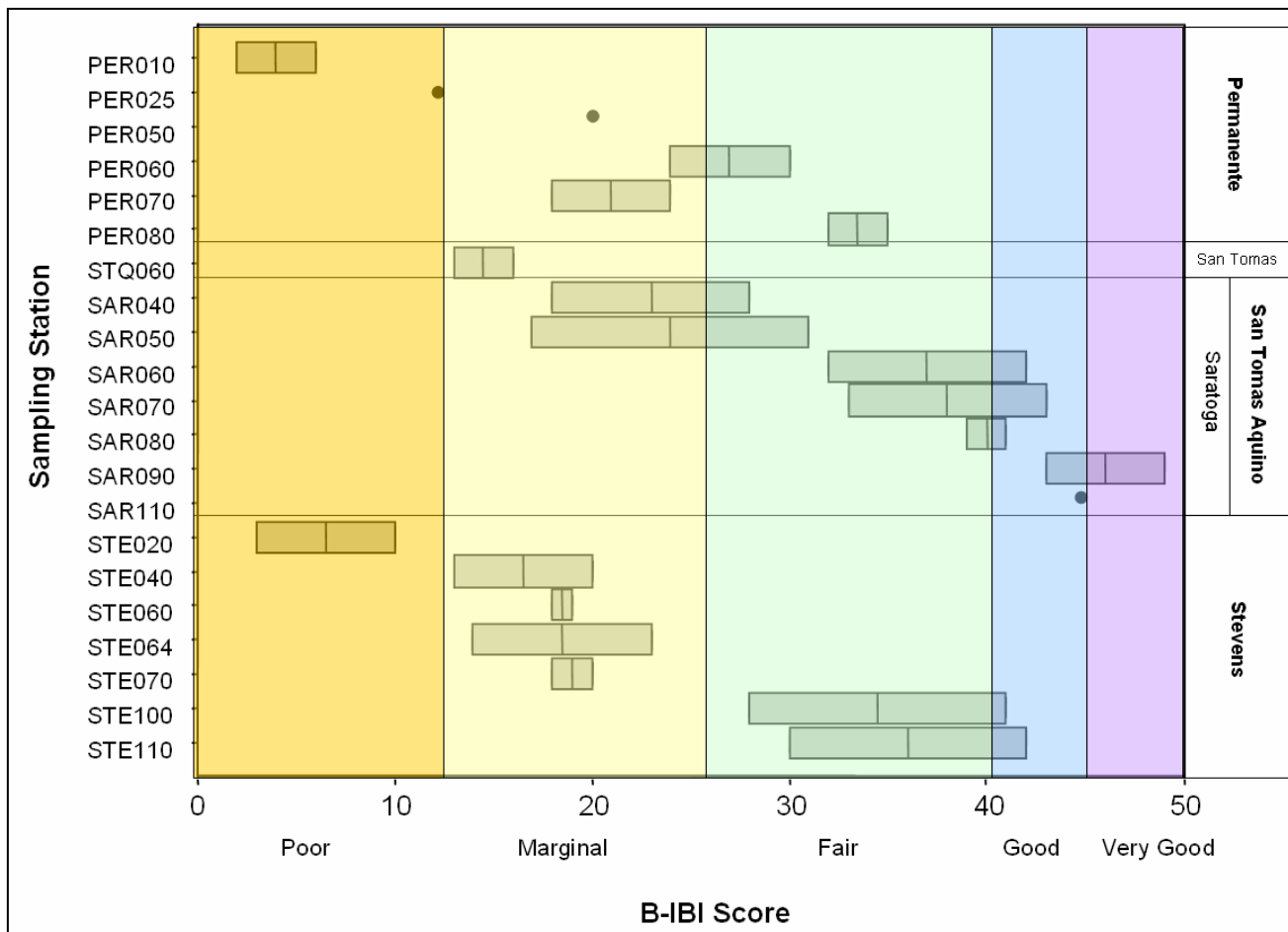
2002-2007

Bioassessments

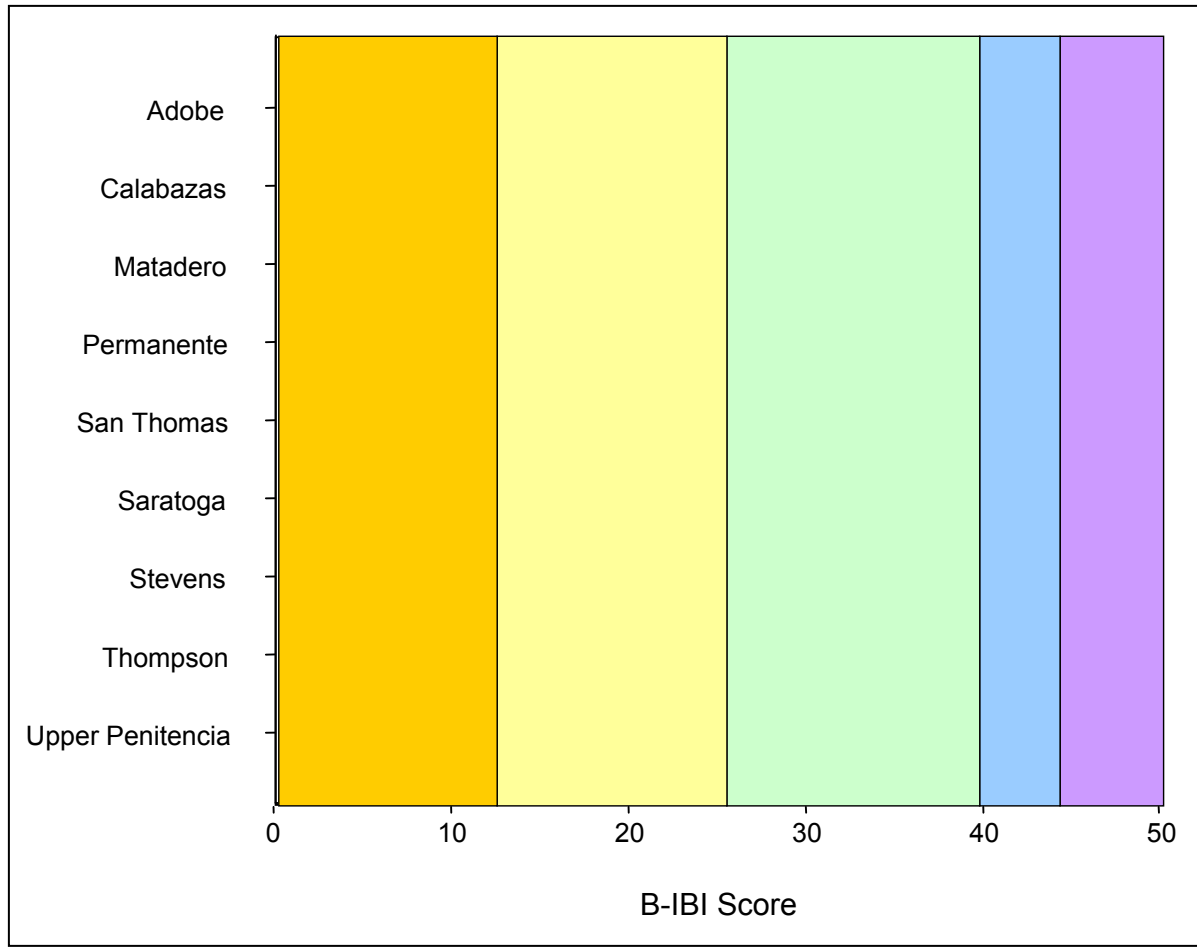
- 69 bioassessments, 41 creek sites, 7 watersheds
- Approximately 39,000 BMIs within 334 distinct taxa
- 74% of BMIs in 5 taxonomic groups

TAXON	TAXONOMIC GROUP	COMMON NAME	TOLERANCE VALUE (0-10)*	% OF ALL ORGANISMS
Chironomidae	Diptera	Non-biting Midges	6	31.0
<i>Baetis</i> sp.	Ephemeroptera	Baetid Mayflies	5	21.3
Oligochaeta	Annelida	Segmented Worms	5	11.4
<i>Simulium</i> sp.	Diptera	Black Flies	6	8.3
<i>Optioservus</i> sp.	Coleoptera	Beetles	4	2.3
			Total	74.3

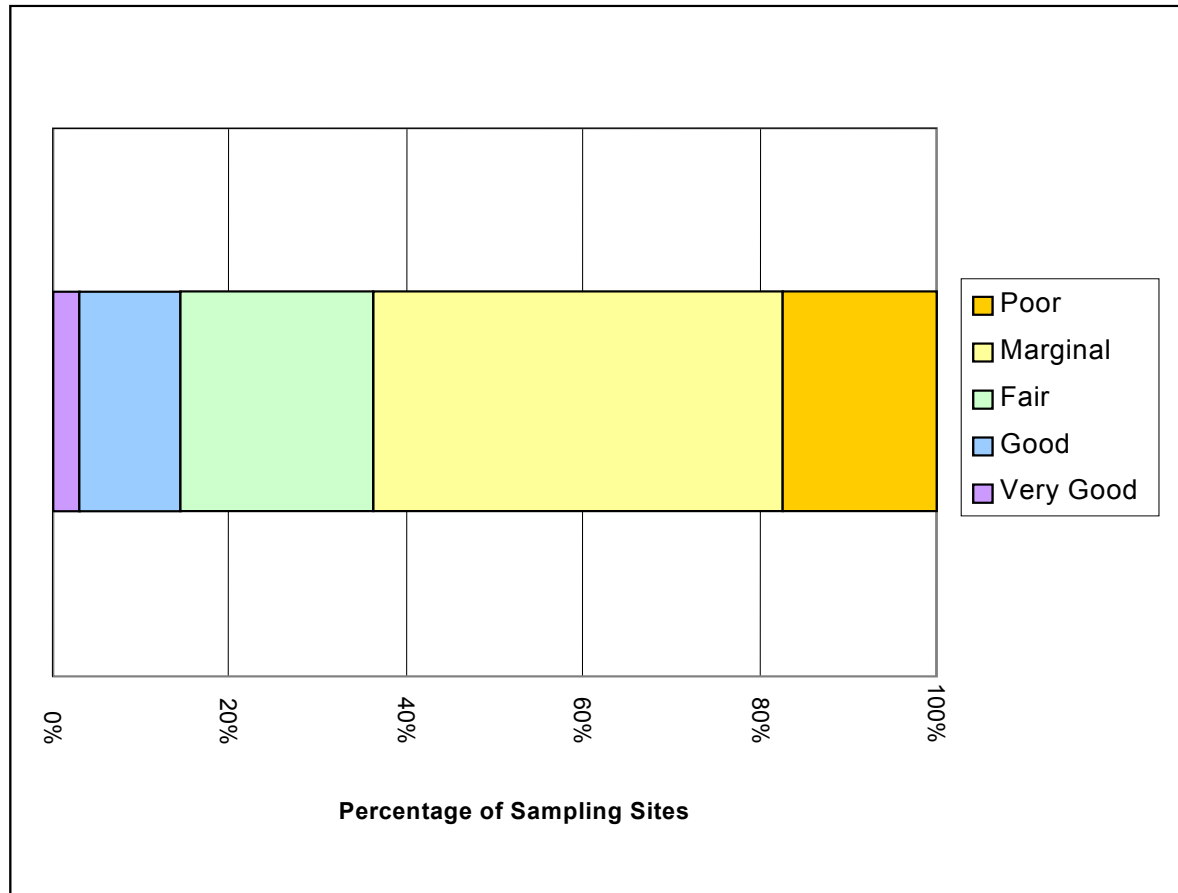
B-IBI Score by Site



B-IBI Score by Watershed



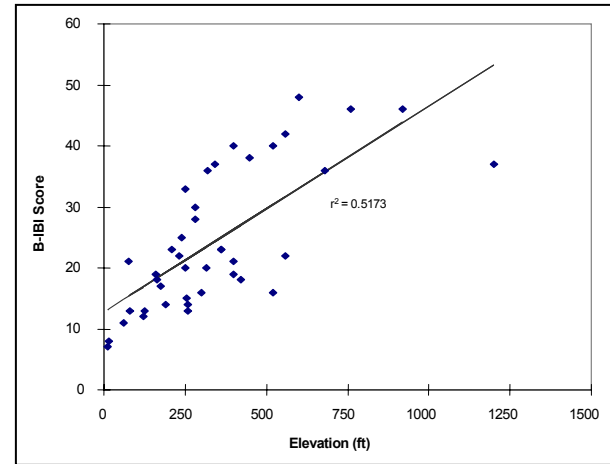
Basin-wide Condition



Variables Explaining B-IBI Scores

■ Elevation

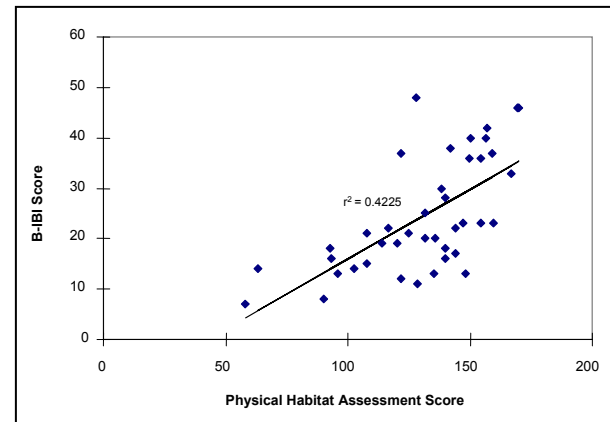
- Surrogate for watershed scale urban intensity?
- Natural variation?
 - Stream Order
 - Hydrological Regime



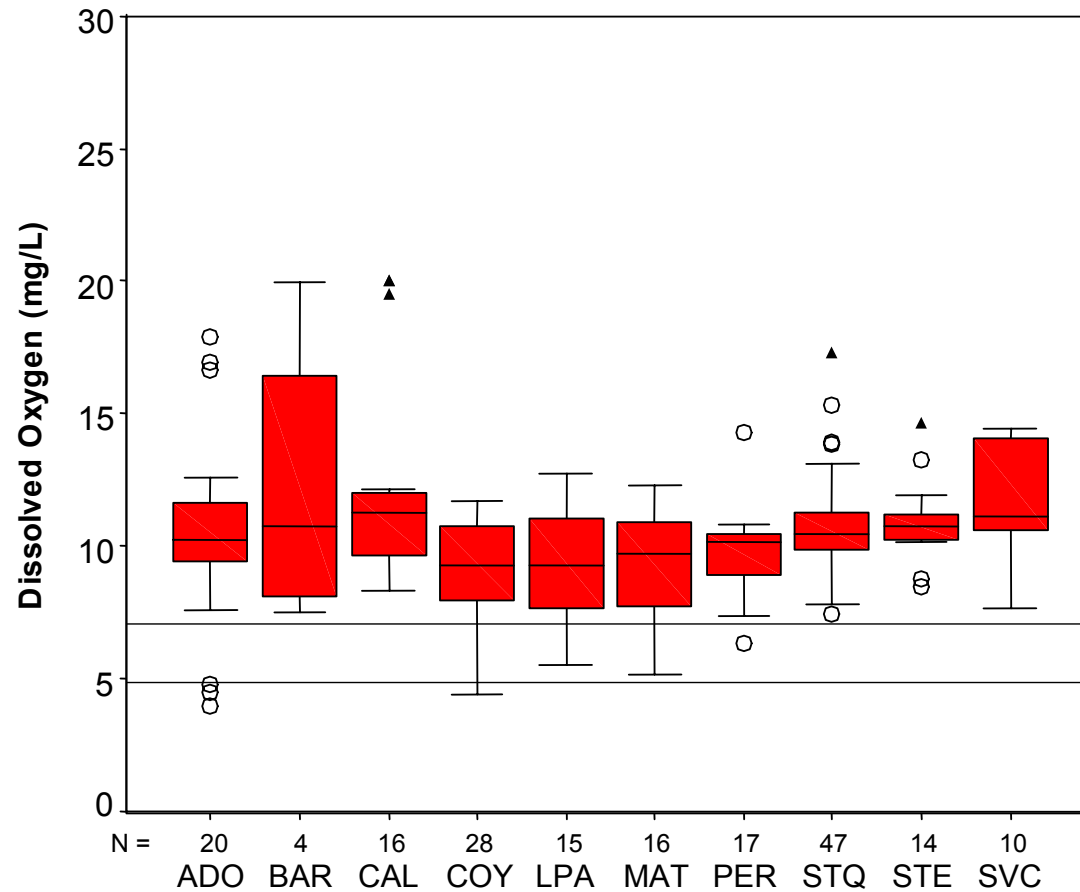
■ Localized Physical Habitat

- Riparian Area
- Substrate Embeddedness
- Habitat Complexity

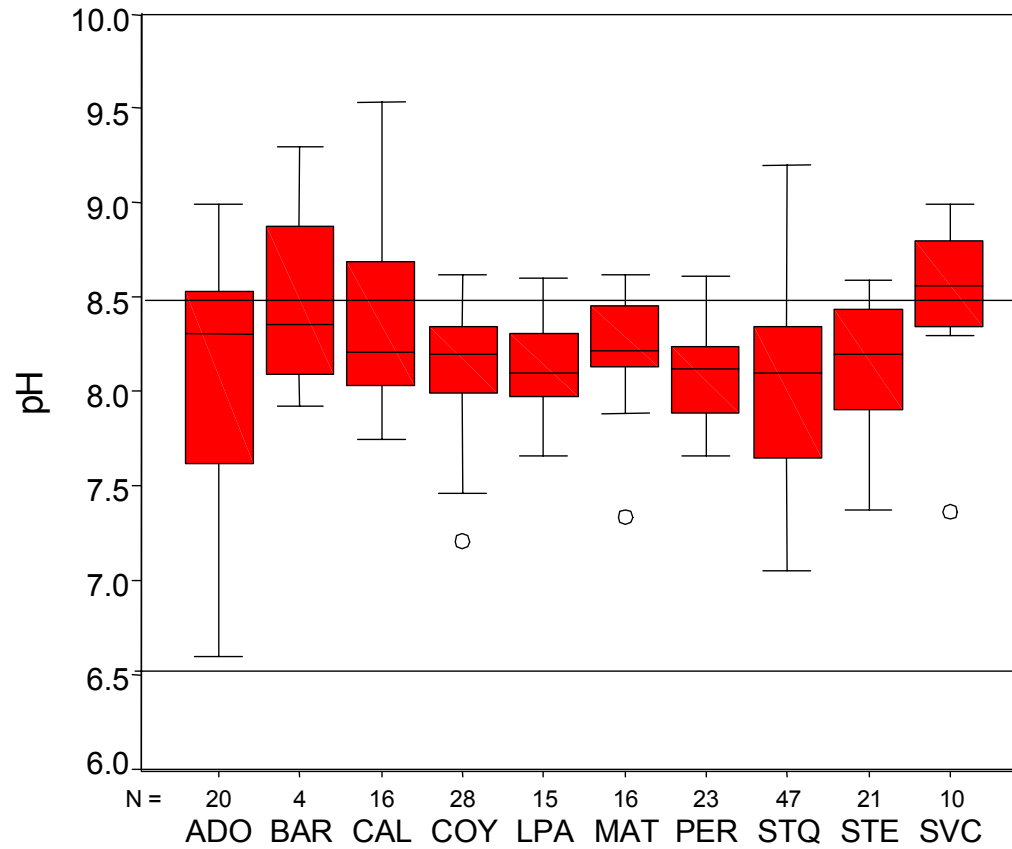
■ Water Quality?



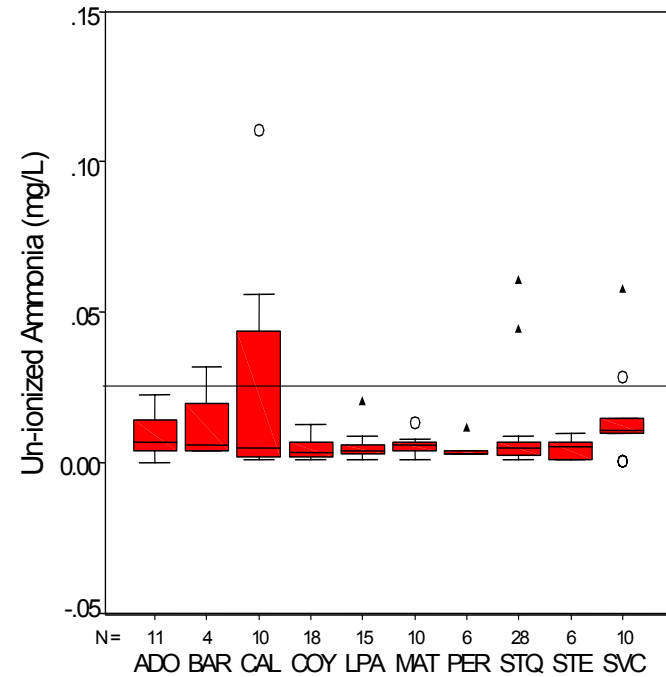
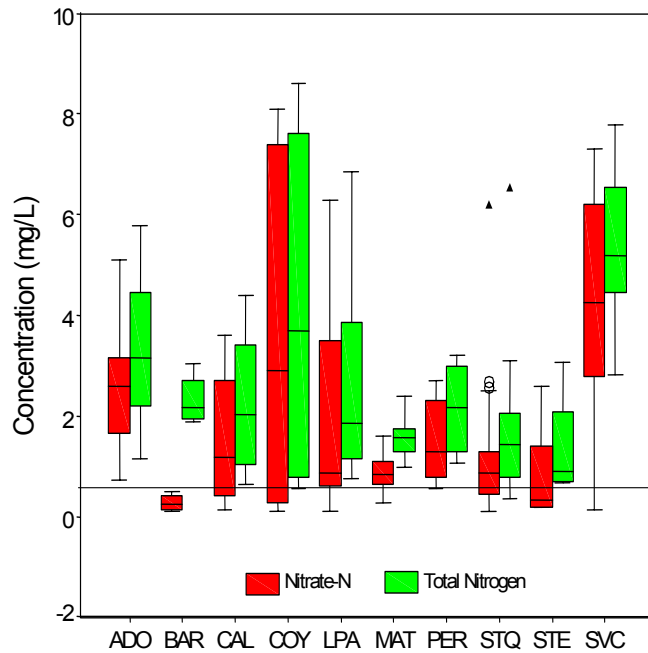
Dissolved Oxygen



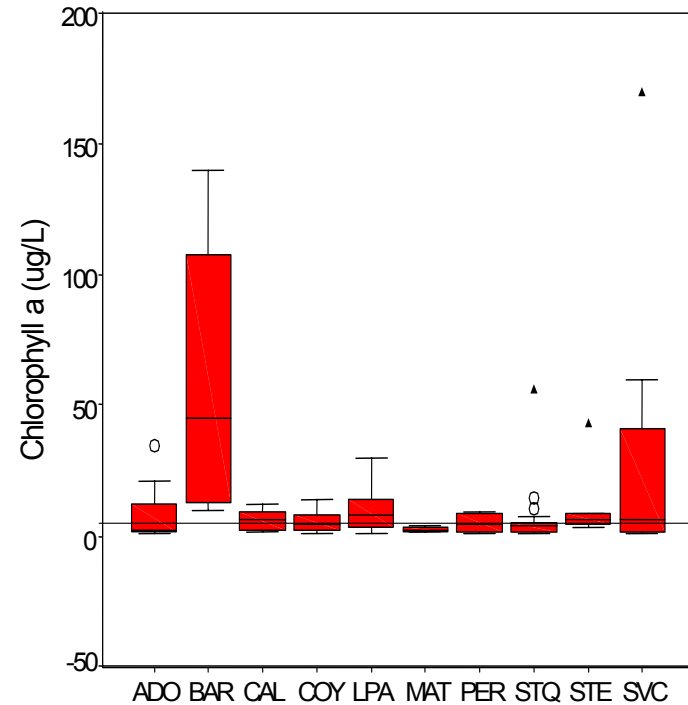
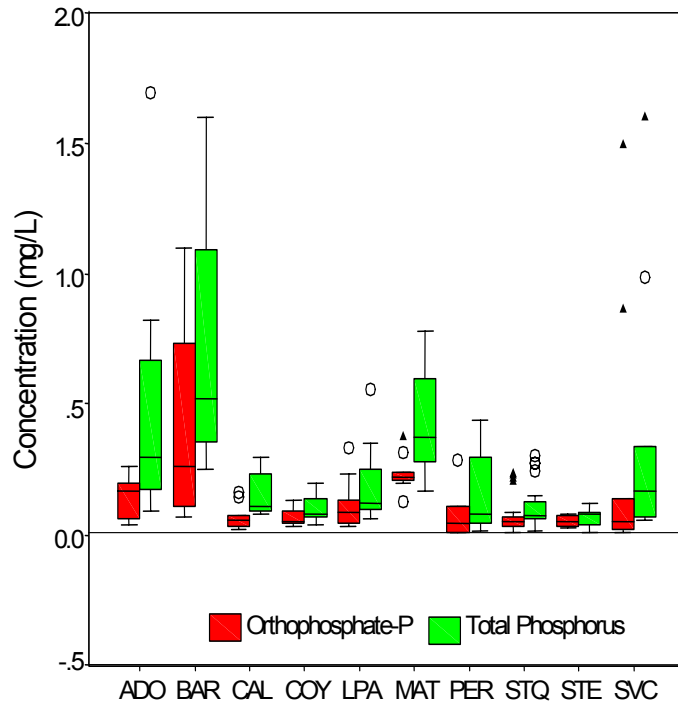
pH



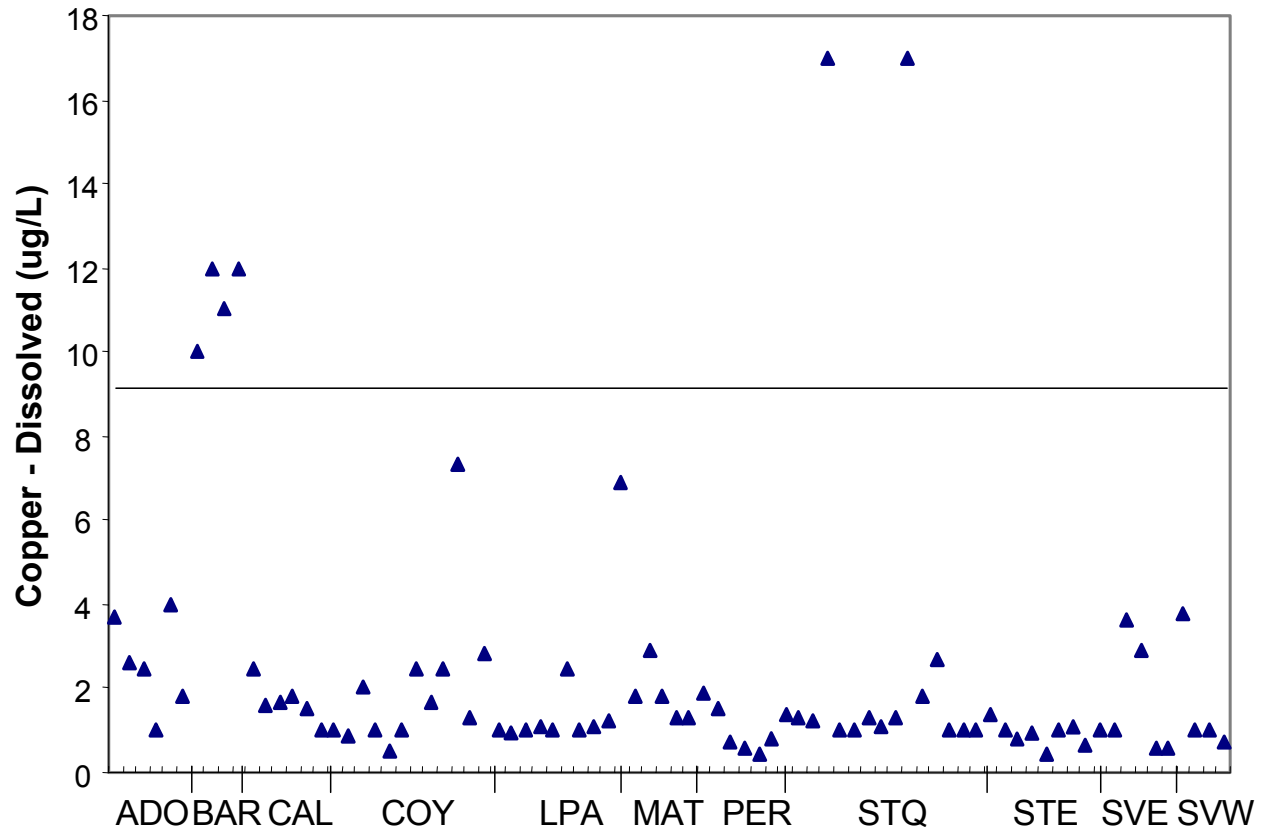
Total Nitrogen, Nitrate and Ammonia



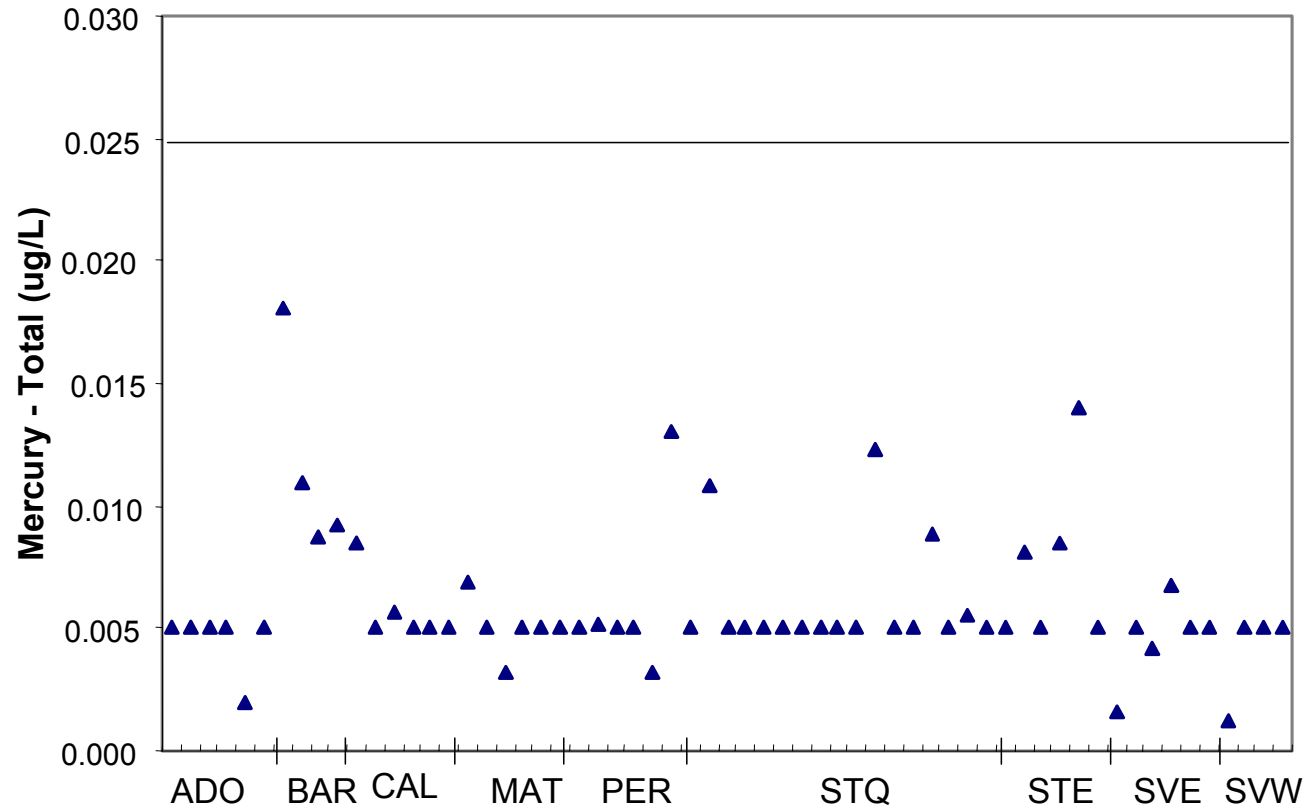
Phosphorous and Chlorophyll a



Copper

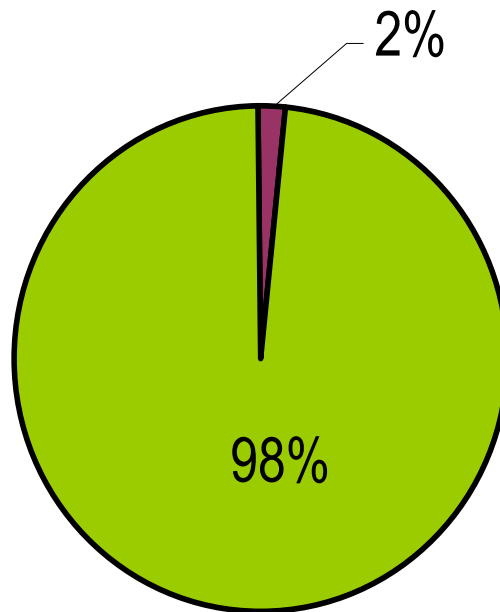


Mercury

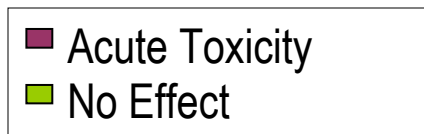
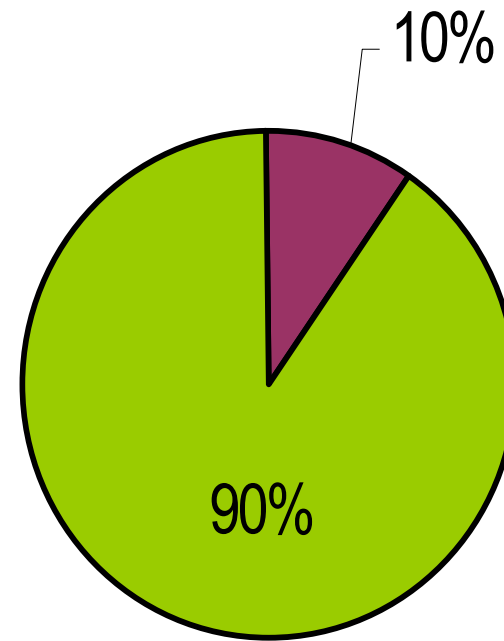


Acute Aquatic Toxicity

Water Flea
(*Ceriodaphnia dubia*)

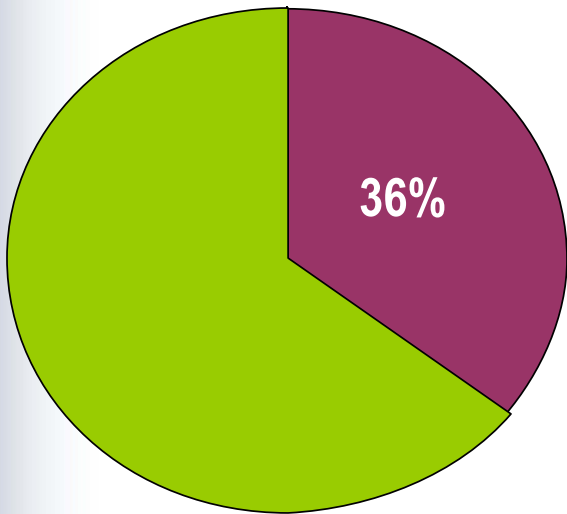


Fathead Minnow
(*Pimephales promelas*)

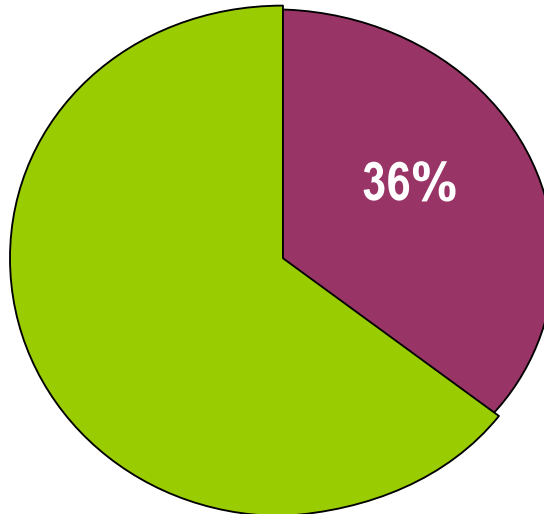


Chronic Aquatic Toxicity

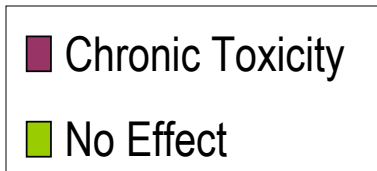
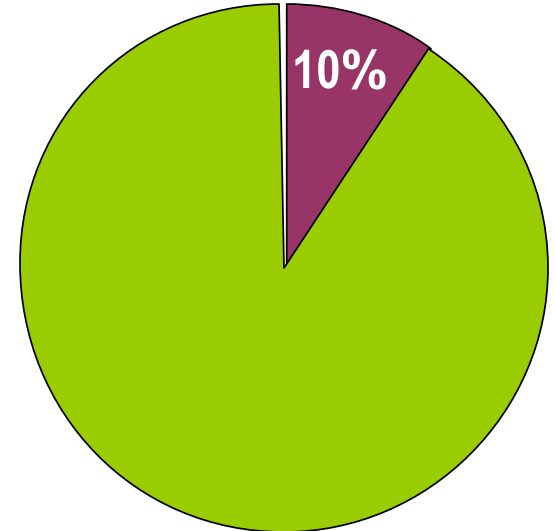
Green Alga
(*Selenastrum capricornutum*)



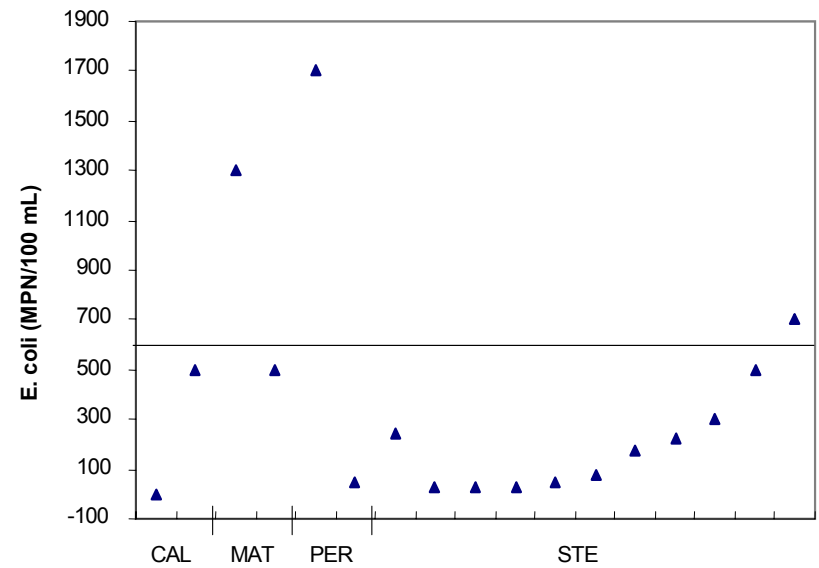
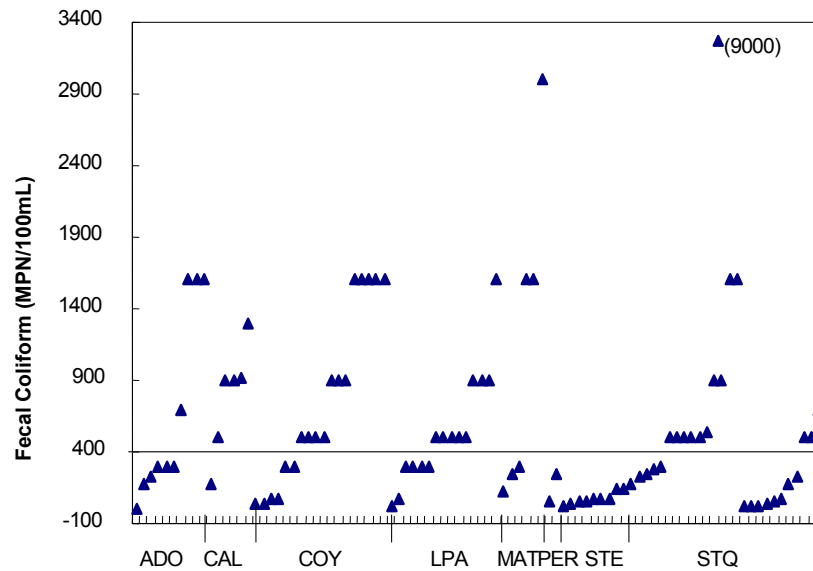
Water Flea
(*Ceriodaphnia dubia*)



Fathead Minnow
(*Pimephales promelas*)



Recreational Uses *Pathogen Indicators*



Preliminary Conclusions

■ Aquatic Life

- B-IBI scores indicate that aquatic life in upper reaches of Stevens, Permanente and Adobe Creek watersheds and Upper Penitencia Creek and Saratoga Creek subwatersheds are in fair to very good condition.
- Upper reaches generally have optimal physical habitat assessment (PHAB) scores and receive drainage from undeveloped or minimally developed lands within County or City Parks and Open Space Districts.
- Many of creek these reaches also support a cold water fish community (i.e., rainbow trout/steelhead)

Preliminary Conclusions

- **Aquatic Life (Continued)**
 - B-IBI scores generally decreased with elevation, suggesting that the effects of urbanization have likely impacted BMI communities overtime.
 - However, warm water fish communities were observed in some watersheds (e.g., Stevens, Saratoga, Adobe and Matadero Creeks)

Preliminary Conclusions

■ Aquatic Life (Continued)

- Numeric water quality objectives (WQOs), criteria and TMDL targets for metals and organic compounds were generally met in all creeks sampled.
 - Over 90% of samples met WQOs/criteria for metals.
 - No exceedences of TMDL targets for diazinon.
 - Dissolved oxygen concentrations at 93% of sampling events met WQOs for cold water habitat.
 - Acute toxicity of water flea and/or minnow only occurred in 2% and 10% of sampling events, respectively.
- Water and sediment quality results to-date do not show significant correlations with B-IBI scores.

Preliminary Conclusions

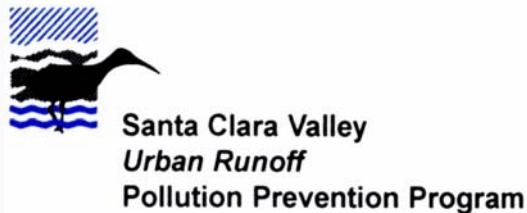
■ Recreational Use

- Pathogen indicator concentrations often exceeded water quality criteria for contact recreation
 - Fecal coliform concentrations (50% of all sampling events)
- Water quality samples, however, were not collected frequently enough to determine if criteria were met or not (5 samples/30 days)
- Although pathogen indicator monitoring sites were selected in areas with high potential for public access, potential risk to exposure was generally very low due to absence of pools and low stream flows during the summer season.

Where do we go from here?

SCVURPPP Watershed Monitoring and Assessment Program

Pilot Sediment Quality Triad *Coyote Creek*



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Managing Scientist

Impetus of Pilot Study

- Samples collected between 2002-2007 suggest that contaminant concentrations are relatively stable and below water quality criteria/objectives during non-storm events.
- Concentrations during and between storm events are highly variable and extensive resources are likely need to understand range, variability and “average” concentrations.

Study Objective

- Evaluate the utility and challenges of using a cost-effective “weight of evidence” approach to assess the status of aquatic life in Santa Clara Basin creeks, and determine the causes of impacts.

Weight of Evidence Approach

- Sediment Quality Triad (SQT)
 - Developed in 1980's for Lakes and Estuaries
 - Uses multiple lines of evidence
 - Stressor and response variables
 - Evaluates degree of benthic ecosystem degradation
 - Can assist in identifying likely causes of impacts

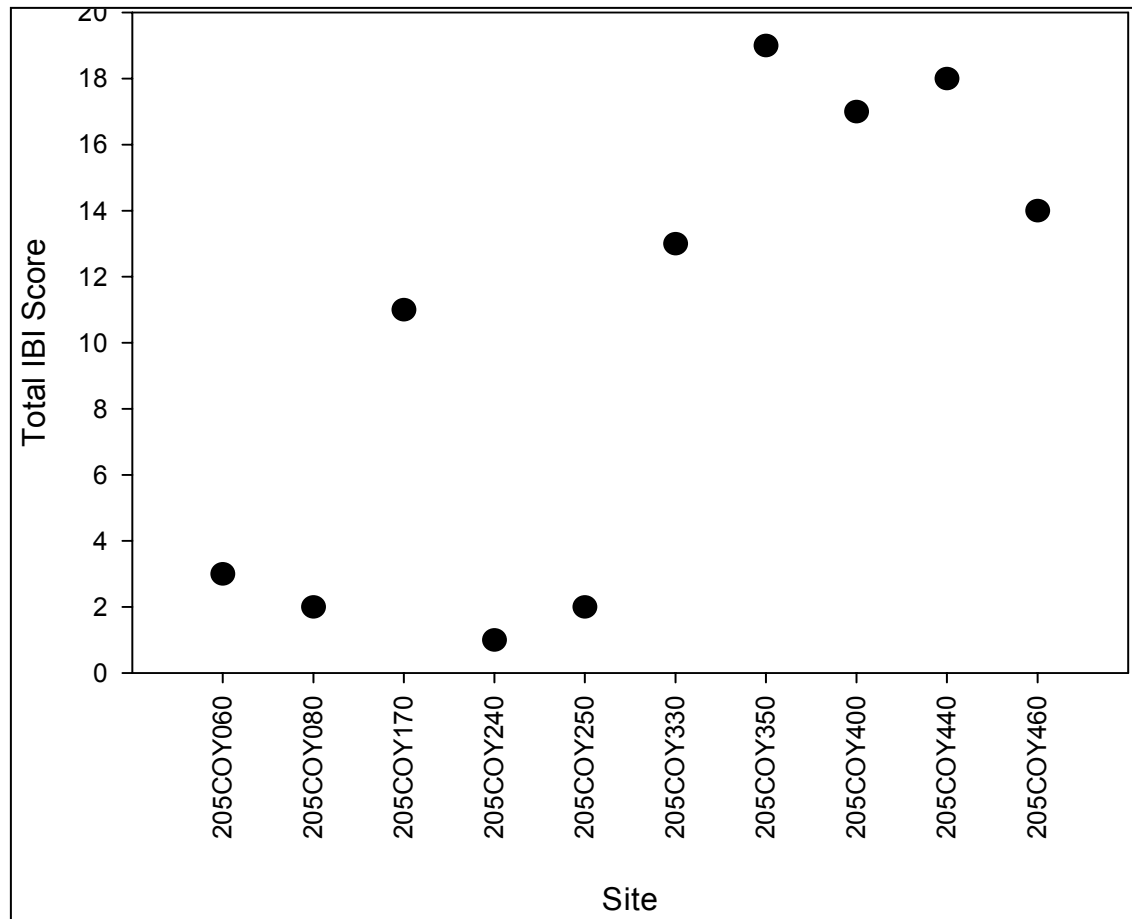
SQT Lines of Evidence

Category	Line of Evidence	Evaluation Tool
Biological	Benthic Macroinvertebrate (BMI) Bioassessments	Draft Preliminary B-IBI for Santa Clara Basin Creeks
Toxicity	10-day Bioassays of Bedded Sediment (<i>Hyalella azteca</i>)	% Survival
Chemistry	Chemical Analyses of Bedded Sediment for Metals, PCBs and Pyrethroids	Mean Sediment Quality Guideline Quotient
Physical Habitat	Qualitative Physical Habitat Assessments	PHAB Score

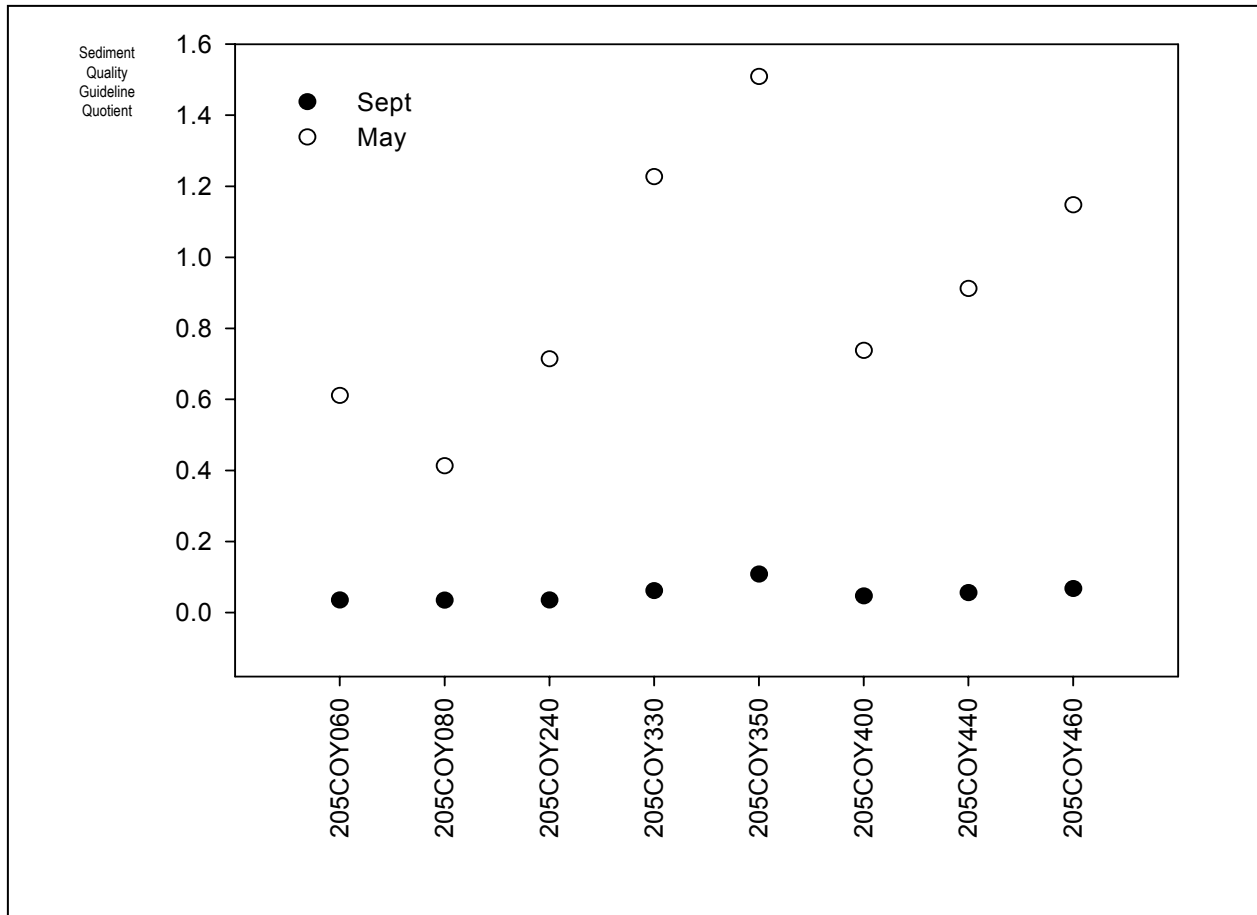
Sampling Sites



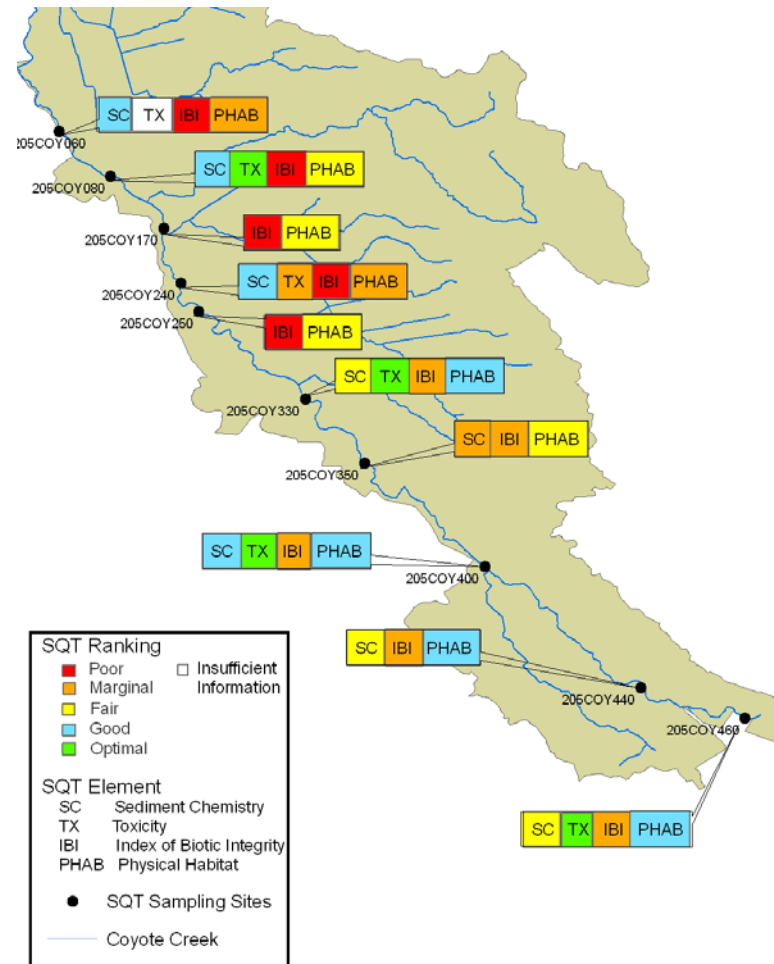
Bioassessment Results



Sediment Quality

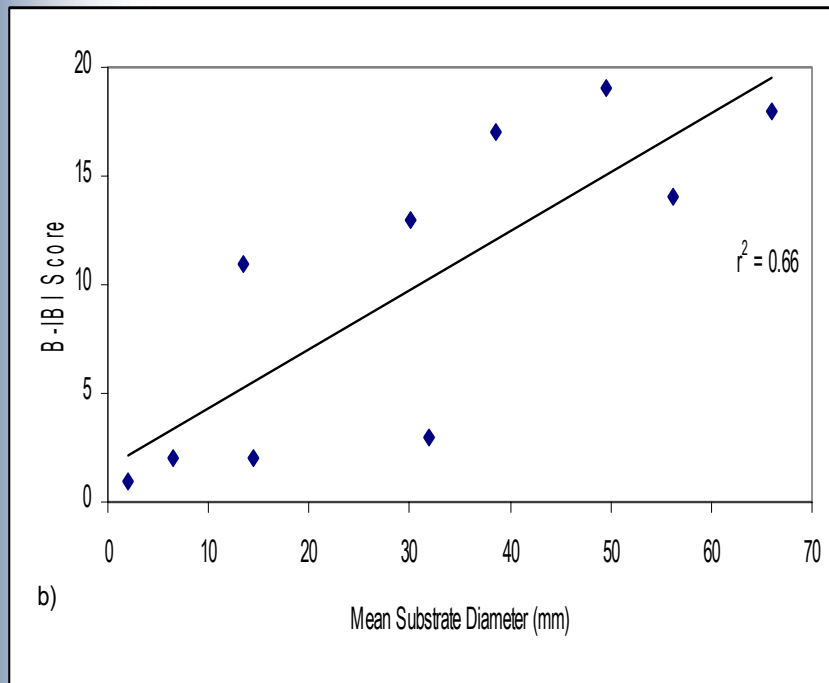


Sediment Quality Triad Results

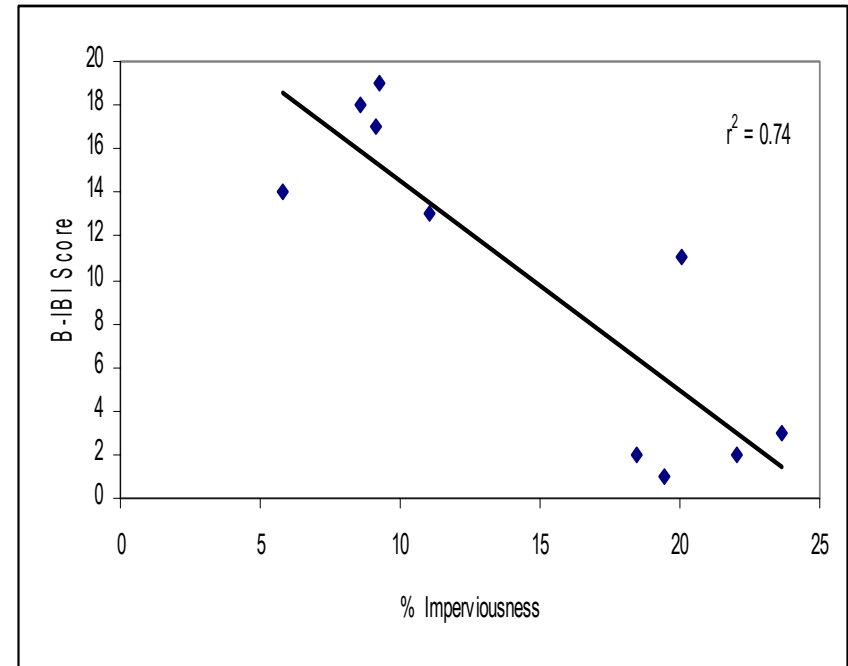


Variables Explaining Biological Integrity

Reach Scale Habitat



Watershed-Scale Characteristics



Conclusions

- Concentrations of total metals (including mercury) and PCBs in bedded sediments were consistently below probable effect concentrations (PECs) in spring 2006 and fall 2007 samples, suggesting that contaminants are not a primary driver of the condition of aquatic life in Coyote Creeks.
- Total metals and PCBs concentrations observed in samples collected in May were an order-of-magnitude higher than those collected during the previous fall, suggesting that contaminants transported during the wet weather season are increasing concentrations in bedded sediment.

Conclusions

- Pyrethroid pesticides were generally not detected above laboratory reporting limits in spring or fall samples, with the exception of Permethrin, which was detected above the published LC50 in nearly all samples collected in May 2007.
- Significant toxicity was consistently observed (5 of 6 samples) prior to the wet weather season, and to a much lesser extent in the spring, suggesting that the relationship between contaminants in sediment and toxicity are not well understood.

Conclusions

- Condition of benthic macroinvertebrate (BMI) communities in Coyote Creek appear to be marginal to poor, and significantly correlated to average substrate size, reach-scale physical habitat scores and cumulative imperiousness.
- A better understanding of variations in sediment contaminant concentrations during the wet weather season is needed given that high seasonal variability observed.

Planned FY 07-08 Monitoring

FY 07-08 Work Plan

- Sediment Quality Triad
 - Coyote Creek Mainstem
 - Coyote Creek Tributaries
 - Upper Penitencia
 - Lower Silver/Thompson
 - Lower Penitencia
- Sediment Contaminant/Toxicity Temporal Variability Study
 - Stevens Creek(?)
- Aquatic Toxicity Follow-up Study (303(d) listing)
 - Stevens Creek

Questions?