

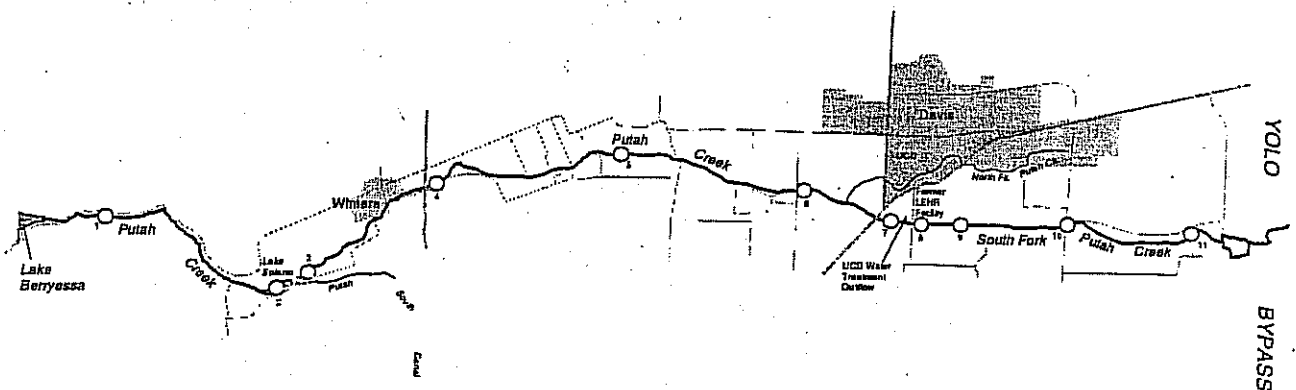
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LOWER PUTAH CREEK 1997-1998 MERCURY BIOLOGICAL DISTRIBUTION STUDY

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1. INTRODUCTION

Largely as a legacy of historic mining activities, water bodies throughout much of Northern and Central California are currently impacted by mercury contamination problems, particularly in relation to the consumption of fish. Mercury is a heavy metal that occurs in a number of different molecular forms. One of these, methyl mercury, has the unfortunate property of bioconcentrating through food webs. This means that the majority of ingested methyl mercury is retained at each trophic (feeding) level, to be passed on to higher level consumers. The result of this is that increasing concentrations of methyl mercury can accumulate at succeeding rungs of the "trophic ladder" and dangerously high levels of methyl mercury can accumulate in the upper level predatory species present in impacted aquatic systems. When these species are utilized as food by humans or wildlife, the concern arises that exposure to neurological toxicity may occur. Methyl mercury is a potent neuro-toxin that has been shown to exhibit effects primarily on rapidly growing nervous system tissue. This places fetuses and young children at greatest risk and is the reason that current fish consumption guidelines are most protective of pregnant women and children under age 6.

Mercury contamination is a serious problem throughout much of the Northern Hemisphere. Across the Midwest and Eastern regions of the United States and Canada, as well as the majority of Europe, trace deposition of global, atmospherically spread mercury (derived from general industrial power production, etc.) has been sufficient to contaminate numerous water bodies to above health guideline levels. In California, we are fortunate to have water quality (typically alkaline and containing higher levels of suspended matter) that is relatively less compatible with the production, solubility, and biological uptake of methyl mercury. However, California water bodies are additionally exposed to massive, bulk mercury contamination from historic mining activities on both sides of the state. The California Coast Ranges contain one of the world's great geologic mercury-enriched belts. When the California Gold Rush occurred in the mid 1800s, relatively inexpensive mercury was used extensively to amalgamate gold, greatly increasing yields. Mercury was used to bind and retain the smaller, otherwise easily lost particles of gold. Upon distilling with heat, the mercury could be vaporized, leaving behind the accumulated gold. This generated a corresponding "Mercury Rush" in California, with dozens of medium to large-scale mercury mining operations in the Coast Ranges supplying refined, elemental mercury ("quicksilver") for use in the Sierra Nevada gold fields. Today, California is the site of numerous abandoned, leaking mercury mines throughout the Coast Ranges and, also, significant tonnage of misplaced elemental mercury throughout the Sierra Nevada gold and

regional sediments. It is notable that the single case of apparently elevated lead in biological tissues came from a composite sample which included tail meat (presumably including intestinal tracts) of 10 large crayfish, which are bottom dwelling omnivore/detritivores. One conclusion that may be drawn is that crayfish may harbor sediment-associated metals in their digestive tracts. Elevated lead was not found in fish muscle in follow-up studies (ATSDR 1998).

Mercury, in comparison to lead, has been extensively documented to bioconcentrate through aquatic food webs, demonstrating incremental elevations in concentration with trophic level and size/age of fish, reaching highest concentrations in large/old individuals of top predator species (Huckabee *et al.* 1979, EPRI 1991, Wiener 1995). Because of the strong relationships typical between fish trophic level and mercury accumulation, and between fish size/age (for many predatory species) and mercury accumulation, it is imperative that exposure comparisons between different sites be made using similar samples. The sampling design of the ATSDR wide-spectrum screening project, however, required very large sample sizes (2 kg) to supply the myriad analyses undertaken. To provide sufficient sample at each site, it was necessary to pool multiple species of unrelated fishes and multiple individuals of widely varying sizes/ages. This resulted in significantly different samples from each of the sites. Where same species were taken, they were often of different life stage and feeding habit. The varied individuals were then mixed together, primarily into groups of surface and water column species (bass, bluegill, crappie) versus bottom dwellers (carp, catfish, bullhead, and crayfish). It is very notable that the background sample in the ATSDR study from above Pedrick Road was composed entirely of juvenile fish and crayfish. The sample was greatly dominated by low-trophic-level juvenile bluegill and green sunfish (521 g of the 620 g composite, or >84%). The remainder of the sample consisted of young largemouth bass (7% of the sample) much smaller than those near the LEHR site and UC Davis (mean size 64 g, as compared to 400-650 g individuals downstream), crayfish (7% of the sample), and a young white catfish (1% of the sample, 89 g, as compared to individual catfish of 700-2,600 g and bullhead in the 200-300 g range at the near-university site). Relative to the low trophic level background sample, the finding of elevated mercury in the samples taken near the university was not surprising. Those samples were dominated by muscle tissue from large individuals of predatory fish species such as catfish and bass.

While the initial ATSDR work did not provide readily comparable data between sites, it served its purpose as a screening study. The presence of elevated mercury in some of the downstream biological composites indicated that mercury levels of concern existed in some fraction of the creek biota. An eminent local biogeochemist, Dr. G. Fred Lee, advised that

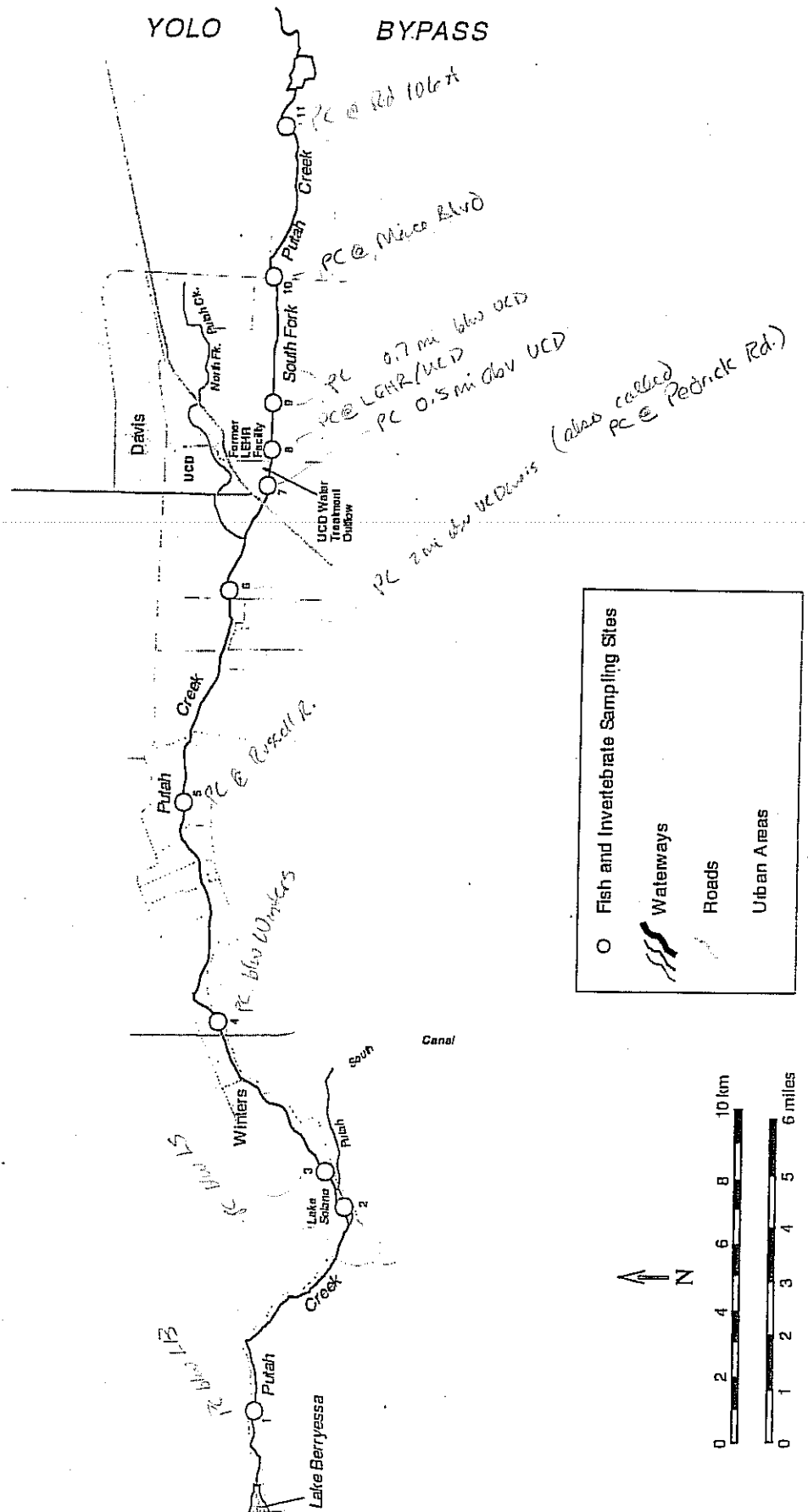
In addition to the primary focus on possible spatial variation in relative mercury levels, a secondary objective of the study was to develop a substantial data base of absolute mercury concentrations for a wide range of aquatic organisms in Putah Creek. These supplement the preliminary work done by ATSDR and can be used by various agencies in determining potential human health and wildlife health exposures. Table 1 summarizes the numbers of mercury analytical samples collected for this project in 1997 and 1998. Total mercury was analyzed in 280 individual biological samples taken from sites along lower Putah Creek between Lake Berryessa and the Yolo Bypass. Additional analytical samples for the project included numerous field and laboratory duplicates, spike recovery samples, and standard reference materials.

Throughout this report, the data for each major sampling parameter are generally presented both in tabular and graphic form. Where appropriate, map figures of the spatial distribution of key data parameters are included for the entire study region. Tables and figures are placed at the ends of each section.

Table 1. Summary of Samples Analyzed for Mercury in This Project

| | |
|--|-----|
| Aquatic Insect Composites: | 25 |
| Small Fish/Tadpole Whole-body Composites: | 48 |
| Individual Crayfish Tail Muscle Samples: | 80 |
| Individual Adult Fish Fillet Muscle Samples: | 127 |
| TOTAL BIOTA SAMPLES: | 280 |

Figure 2. Lower Putah Creek, With Sampling Locations



2.2 Collection and Sample Preparatory Techniques

2.2.1 Fish

Adult fish for muscle (fillet) mercury analysis were taken primarily with several large experimental gill nets containing a wide range of mesh sizes. These were deployed from a small boat equipped with an outboard motor. In several cases the boat needed to be dragged overland a considerable distance to reach the water. Once deployed, nets were monitored closely and were harvested frequently so as to avoid fish mortality. Fish were maintained live in holding tanks and were rapidly processed on the boat and then released, generally in good condition. Processing included species identification, measurement of standard and fork length, weighing, and careful removal of a small sample of fillet muscle (0.20 grams, similar in size to a raisin). Fish were released approximately 0.5 km from their capture point so as not to be re-netted. Multiple days of sampling were required at several of the sites.

Tissue samples for mercury analysis were excised using clean technique, with stainless steel scalpels. Muscle samples were taken from the dorso-lateral ("shoulder") region, as done by the California Department of Fish and Game. A small patch of skin/scales was pulled back to obtain the clean muscle sample. Extraneous surface moisture was blotted off with a laboratory tissue and the sample was placed directly into a pre-weighed laboratory digestion tube, which was capped with a teflon liner. The precise weight of each tissue sample was determined by weighing the tubes containing samples (together with pre-weighed blanks) and subtracting the initial empty weights. We have utilized these non-destructive sampling techniques with great success in similar work over the past 15 years (Reuter *et al.* 1989, 1998, Slotton 1991, Slotton *et al.* 1995a,b, 1996, 1997a,b,c).

2.2.3 Small and juvenile fish

Small and juvenile fish were taken from stream sites, where present, utilizing both a research electroshocker and seines which were pulled through certain stretches to trap fish. Individuals to be analyzed for mercury were held on ice in sealed bags. They were later (within 24 hours) cleaned in DI water at the UCD laboratory, identified, weighed and measured, and homogenized into appropriate composite samples with a laboratory homogenizer. An aliquot of the homogenized sample was precisely weighed into a laboratory digestion tube, which was capped with a teflon liner.

were corrected for individual moisture percentage so as to present this data (for a potential human consumption item) in the same units used for edible fish tissue (fresh/wet weight parts per million mercury).

2.3 Analytical Methodology

Fish were analyzed on a wet (fresh) basis, as is the standard procedure for governmental agencies. Mercury analyses of invertebrate samples were conducted with dried and powdered samples for uniformity, as described in Slotton *et al.* (1995a).

Solid samples of all types were processed by first digesting in concentrated sulfuric and nitric acids, under pressure, at 80-100 °C, followed by refluxing with potassium permanganate in a two stage, three hour process. Digests were subsequently analyzed for total mercury using a well-established modified cold vapor atomic absorption (CVAA) micro-technique, described in Slotton *et al.* (1995b). The level of detection for this technique is app. 0.01 $\mu\text{g g}^{-1}$ (ppm), sufficient to provide above-detection results for nearly all environmental samples from this region.

2.4 Quality Assurance/Quality Control (QA/QC)

Extensive QA/QC accompanied all of the total mercury analyses. For each sample batch of approximately 40 samples, at least 16 QA/QC samples were included through all phases of the digestion and analysis procedures. These included a minimum of: 1 blank and 7 aqueous mercury standards, 2 pairs of samples of standard reference materials (4 total) with known mercury concentrations, 2 duplicates of analytical samples, and 2 spiked analytical samples. These 16+ additional samples per analytical run were used, as always, to ensure the reliability of the data generated. The QA/QC results for the analytical work are summarized in Table 2.

The extensive set of aqueous standards was used to construct an accurate curve of mercury concentration vs atomic absorbence for each analytical run. The standard curve R^2 values for the mercury runs utilized in this project all fell between 0.997 and 1.000, well above the control range of ≥ 0.975 . The reference material samples included two different fish standards. All recoveries were well within the 75-125% control levels, at 89-113% (mean recoveries 95-106%). Sample duplication in laboratory splits was excellent, with relative % difference (RPD) having a mean value of 4.9% among 40 sets of paired samples. Independent field duplicates were also very close, with RPDs of 11 sets of paired, independent field samples averaging 6.2%. Spike recoveries were consistently

3. RESULTS AND DISCUSSION

3.1 Adult Fish

Muscle mercury data from the adult fish samples are presented in Table 3. The data are plotted graphically by sampling site in Figures 3(a-i), with all individuals and species from a given site plotted together (each species with its own symbol). This allows the inter-site comparison of overall mercury levels in all the fish taken and also displays the relative mercury levels of different species within each site. In Figures 4(a-j), the data are plotted by fish species, with each sampling site having a different symbol. This allows consistent comparison of the various sites. Because mercury concentration frequently varies with size/age of fish, particularly for predatory species, mercury data are plotted against fish weight. Data for individual sites can be compared to the general size:mercury trend for the species. Sites with significantly different mercury exposure levels would be expected to demonstrate correspondingly different fish muscle mercury concentrations, relative to the general size:mercury trend for a given species among all the sites.

The Putah Creek fish muscle mercury data provide comparative information to muscle mercury data from numerous UC Davis research projects conducted over the past 15 years throughout the mercury and gold mining regions of Northern California (Reuter *et al.* 1989, 1996, 1998, Slotton *et al.* 1991, 1995a,b, 1996, 1997a,c, Suchanek *et al.* 1993, 1997, TSMP 1990-1997), as well as the large data base that exists for edible fish fillet tissue throughout the state of California, assembled by the Toxic Substances Monitoring Program (TSMP 1990-1997). The fish muscle mercury data collected in this project supplement the preliminary Putah Creek work done by the ATSDR and EPA Region 9 (ATSDR 1997, 1998, NAREL 1997) and characterize, for the entire Putah Creek study region between Lake Berryessa and the Yolo Bypass, mercury levels in the edible tissue of most numerically significant species, including those commonly taken for human consumption. Fish muscle mercury data will be discussed in relation to two primary considerations: (1) absolute mercury levels in edible muscle tissue, with regard to human health issues, and (2) relative spatial differences in fish mercury concentrations, primarily in relation to potential effects related to UC Davis.

As is typical, muscle mercury concentrations were lowest in fish species which feed on low trophic level food items such as plankton and small aquatic insects and were highest in large individuals of top predator species which feed primarily on other fishes. Intermediate mercury levels were seen in species which feed on intermediate trophic level food items such as large aquatic insects and juvenile fish. Because of the changing nature of Putah Creek across the study region, different assemblages of fish species occur in different

A single individual taken upstream from Lake Solano was somewhat elevated at 0.12 ppm, particularly in relation to the size of the fish (95 g, vs 305-360 g at Site 9).

Sacramento blackfish (*Orthodon microlepidotus*, Fig. 4c): Planktivorous Sacramento blackfish were relatively low in muscle mercury throughout, with 19 of 20 individuals having concentrations ≤ 0.15 ppm. Mean blackfish mercury levels increased slightly across a range of sizes (200-1200 g), from ~0.06 ppm to ~0.10 ppm, with an overall mean of approximately 0.08 ppm. Consistent samples of this species were taken at Site 6 (above UC Davis near Pedrick Rd), Site 9 (0.5-1.0 mile downstream of the UC Davis water treatment outflow and the LEHR site), and Site 11 (6 miles downstream of UCD at Rd 106A). Concentrations from Sites 6 and 9, above and below UC Davis, fell within an identical size:Hg pattern, indicating very similar levels of mercury exposure/uptake in these two reaches of the creek. At the furthest downstream site (Site 11, 6 miles downstream of UC Davis), the blackfish data indicate a possible elevation in localized mercury exposure/uptake. Of the seven fish sampled at that site, one exhibited an anomalously elevated concentration (600 g, 0.23 ppm Hg) and slightly above-trend concentrations were apparent in some of the others.

Sacramento sucker (*Catostomus occidentalis*, Fig. 4d): This species is a native bottom fish which feeds primarily on small bottom-dwelling invertebrates. Adult Sacramento suckers were available for collection only at sites located above UC Davis. Individuals taken from Sites 3, 5, and 6 (below Lake Solano to just above UC Davis) had a very similar pattern of concentrations (0.10-0.18 ppm Hg in all 9 individuals, 100-900 g). Mean levels increased slightly with size of fish. The sample of five suckers taken from within Lake Solano (Site 2) was significantly elevated in muscle mercury relative to the trend seen at the other sites (0.32-0.52 ppm Hg in all 5 fish). While these lake-dwelling individuals were also significantly larger (1,100-1,900 g) than the individuals collected from the downstream creek, their muscle mercury concentrations were clearly elevated above the trend line described by the creek population.

Carp (*Cyprinus carpio*, Fig. 4e): Fifteen large, adult carp were sampled from Putah Creek, primarily from downstream sites, within the extended size range of 500-4,900 g (1.1-10.8 lbs). All of these individuals exhibited low to moderate muscle mercury concentrations between 0.12 and 0.25 ppm, consistent with their relatively low trophic position, consuming small benthic invertebrates and plant material from the bottom (Moyle 1976). Little or no size-based increase in concentrations was noted, with mean levels

and a single full-sized adult weighing 990 g (2.2 lbs) and containing 0.48 ppm muscle mercury. While this sample was not sufficient to produce a tight size:Hg relationship for the species, the two fish taken at Site 11 appear to demonstrate relatively elevated muscle mercury levels. At 165 and 250 g, these two fish had very similar, very high muscle mercury levels (0.72, 0.73 ppm), notably elevated above the apparent relationship seen at Site 5.

White crappie, black crappie (*Pomoxis annularis*, *Pomoxis nigromaculatus*, Fig. 4i): Crappie become predators of other fish as adults and are prized by anglers. A single large individual (735 g) was taken at Site 11, 6 miles below UC Davis at Rd. 106A. This individual contained one of the highest muscle mercury concentrations found in the study (0.63 ppm). Comparable, large individual crappie were not available from other sites. A sample of 3 young individuals was collected from Site 6, upstream of the university (48-83 g, 0.15-0.19 ppm Hg), together with a slightly larger black crappie (103 g, 0.33 ppm Hg). As no fish of intermediate size were collected, it is not clear whether the downstream adult represented anomalously high, site-specific levels or an elevation solely attributable to size and feeding habits. A very steep size:Hg relationship, with similar high top-end levels, was found in collections we made for Yolo County in the lower portion of Cache Creek (Slotton et al. 1997c).

Largemouth bass, smallmouth bass (*Micropterus salmoides*, *Micropterus dolomieu*, Fig. 4j): These prized, warmwater gamefish species use their large mouths to capture other fish and a variety of large prey items. Adult largemouth bass are one of the primary top predator fish species in the lower portion of the creek. Collections at upstream sites yielded only juveniles and post-juveniles (40-110 g) of either species, which had muscle mercury at 0.15-0.35 ppm. Four adult largemouth bass of 600-2,000 g were taken at Site 9 approximately 1 mile downstream of UC Davis. The two smaller individuals of these adults had mercury concentrations similar to the smaller bass (0.20-0.23 ppm), while the larger, piscivorous (fish-eating) individuals demonstrated a typical predatory size:Hg relationship (1,120 g and 0.34 ppm Hg, 1,920 g and 0.62 ppm Hg). Two 900-1,000 g adult largemouth bass were taken at the most downstream site (Site 11). At 0.63 and 0.73 ppm Hg, the concentrations from this site appear to be elevated above the general size:Hg relationship described by bass data from the other sites.

Table 3. Putah Creek Fish Muscle (Fillet) Mercury. (continued)
(fresh/wet weight ppm Hg)

| Site # | Site Description | Fish Species | Weight (g) | Length (mm) | Muscle Hg (wet wt ppm) |
|--------|-------------------------|------------------|------------|-------------|------------------------|
| ✓ 6 | Putah Ck 2 mi above UCD | Sac. Blackfish | 580 | 335 | 0.06 |
| 6 | Putah Ck 2 mi above UCD | Sac. Blackfish | 630 | 335 | 0.09 |
| ✓ 6 | Putah Ck 2 mi above UCD | Sac. Blackfish | 700 | 366 | 0.09 |
| 6 | Putah Ck 2 mi above UCD | Sac. Blackfish | 920 | 379 | 0.09 |
| 6 | Putah Ck 2 mi above UCD | Sac. Blackfish | 1,000 | 397 | 0.10 |
| 6 | Putah Ck 2 mi above UCD | Sac. Sucker | 470 | 377 | 0.13 |
| ✓ 6 | Putah Ck 2 mi above UCD | Sac. Sucker | 625 | 364 | 0.13 |
| ✓ 6 | Putah Ck 2 mi above UCD | Carp | 1,520 | 435 | 0.22 |
| ✓ 6 | Putah Ck 2 mi above UCD | Redear Sunfish | 153 | 192 | 0.15 |
| ✓ 6 | Putah Ck 2 mi above UCD | Sunfish (Hybrid) | 131 | 178 | 0.19 |
| 6 | Putah Ck 2 mi above UCD | Bluegill | 50 | 135 | 0.19 |
| 6 | Putah Ck 2 mi above UCD | Bluegill | 55 | 140 | 0.22 |
| 6 | Putah Ck 2 mi above UCD | Bluegill | 75 | 135 | 0.20 |
| ✓ 6 | Putah Ck 2 mi above UCD | Bluegill | 85 | 147 | 0.14 |
| 6 | Putah Ck 2 mi above UCD | Bluegill | 85 | 148 | 0.24 |
| 6 | Putah Ck 2 mi above UCD | Bluegill | 112 | 177 | 0.32 |
| 6 | Putah Ck 2 mi above UCD | Bluegill | 112 | 153 | 0.18 |
| 6 | Putah Ck 2 mi above UCD | Channel Catfish | 205 | 256 | 0.13 |
| 6 | Putah Ck 2 mi above UCD | Channel Catfish | 710 | 365 | 0.34 |
| 6 | Putah Ck 2 mi above UCD | Channel Catfish | 750 | 378 | 0.11 |
| 6 | Putah Ck 2 mi above UCD | Channel Catfish | 1,110 | 437 | 0.23 |
| ✓ 6 | Putah Ck 2 mi above UCD | Channel Catfish | 1,280 | 413 | 0.17 |
| 6 | Putah Ck 2 mi above UCD | Channel Catfish | 1,570 | 470 | 0.12 |
| 6 | Putah Ck 2 mi above UCD | Channel Catfish | 1,660 | 510 | 0.07 |
| 6 | Putah Ck 2 mi above UCD | Channel Catfish | 1,970 | 500 | 0.18 |
| 6 | Putah Ck 2 mi above UCD | White Crappie | 48 | 165 | 0.19 |
| ✓ 6 | Putah Ck 2 mi above UCD | White Crappie | 50 | 167 | 0.15 |
| 6 | Putah Ck 2 mi above UCD | White Crappie | 83 | 190 | 0.16 |
| ✓ 6 | Putah Ck 2 mi above UCD | Black Crappie | 103 | 192 | 0.33 |
| ✓ 6 | Putah Ck 2 mi above UCD | Smallmouth Bass | 100 | 209 | 0.35 |
| ✓ 6 | Putah Ck 2 mi above UCD | Largemouth Bass | 52 | 160 | 0.34 |

(continued)

Table 3. Putah Creek Fish Muscle (Fillet) Mercury. (continued)
(fresh/wet weight ppm Hg)

| <u>Site #</u> | <u>Site Description</u> | <u>Fish Species</u> | <u>Weight (g)</u> | <u>Length (mm)</u> | <u>Muscle Hg (wet wt ppm)</u> |
|---------------|-------------------------|---------------------|-------------------|--------------------|-------------------------------|
| 11 | Putah Ck. at Rd. 106A | Sac. Blackfish | 285 | 276 | 0.07 |
| 11 | Putah Ck. at Rd. 106A | Sac. Blackfish | 315 | 284 | 0.08 |
| 11 | Putah Ck. at Rd. 106A | Sac. Blackfish | 355 | 303 | 0.12 |
| ✓ 11 | Putah Ck. at Rd. 106A | Sac. Blackfish | 385 | 303 | 0.07 |
| 11 | Putah Ck. at Rd. 106A | Sac. Blackfish | 505 | 338 | 0.06 |
| 11 | Putah Ck. at Rd. 106A | Sac. Blackfish | 600 | 367 | 0.23 |
| 11 | Putah Ck. at Rd. 106A | Sac. Blackfish | 840 | 398 | 0.14 |
| 11 | Putah Ck. at Rd. 106A | Carp | 535 | 333 | 0.23 |
| 11 | Putah Ck. at Rd. 106A | Carp | 805 | 362 | 0.14 |
| 11 | Putah Ck. at Rd. 106A | Carp | 1,040 | 411 | 0.15 |
| ✓ 11 | Putah Ck. at Rd. 106A | Carp | 1,210 | 402 | 0.15 |
| 11 | Putah Ck. at Rd. 106A | Carp | 1,280 | 432 | 0.20 |
| 11 | Putah Ck. at Rd. 106A | Carp | 1,440 | 427 | 0.16 |
| 11 | Putah Ck. at Rd. 106A | Carp | 1,750 | 457 | 0.25 |
| ✓ 11 | Putah Ck. at Rd. 106A | Channel Catfish | 480 | 349 | 0.08 |
| 11 | Putah Ck. at Rd. 106A | Channel Catfish | 740 | 394 | 0.07 |
| ✓ 11 | Putah Ck. at Rd. 106A | White Catfish | 545 | 320 | 0.18 |
| 11 | Putah Ck. at Rd. 106A | Largemouth Bass | 930 | 387 | 0.73 |
| ✓ 11 | Putah Ck. at Rd. 106A | Largemouth Bass | 970 | 385 | 0.63 |
| ✓ 11 | Putah Ck. at Rd. 106A | White Crappie | 735 | 359 | 0.63 |
| 11 | Putah Ck. at Rd. 106A | Squawfish | 165 | 252 | 0.72 |
| 11 | Putah Ck. at Rd. 106A | Squawfish | 250 | 318 | 0.73 |

Fig. 3(c) Fish muscle mercury
SITE 3: JUST BELOW LAKE SOLANO

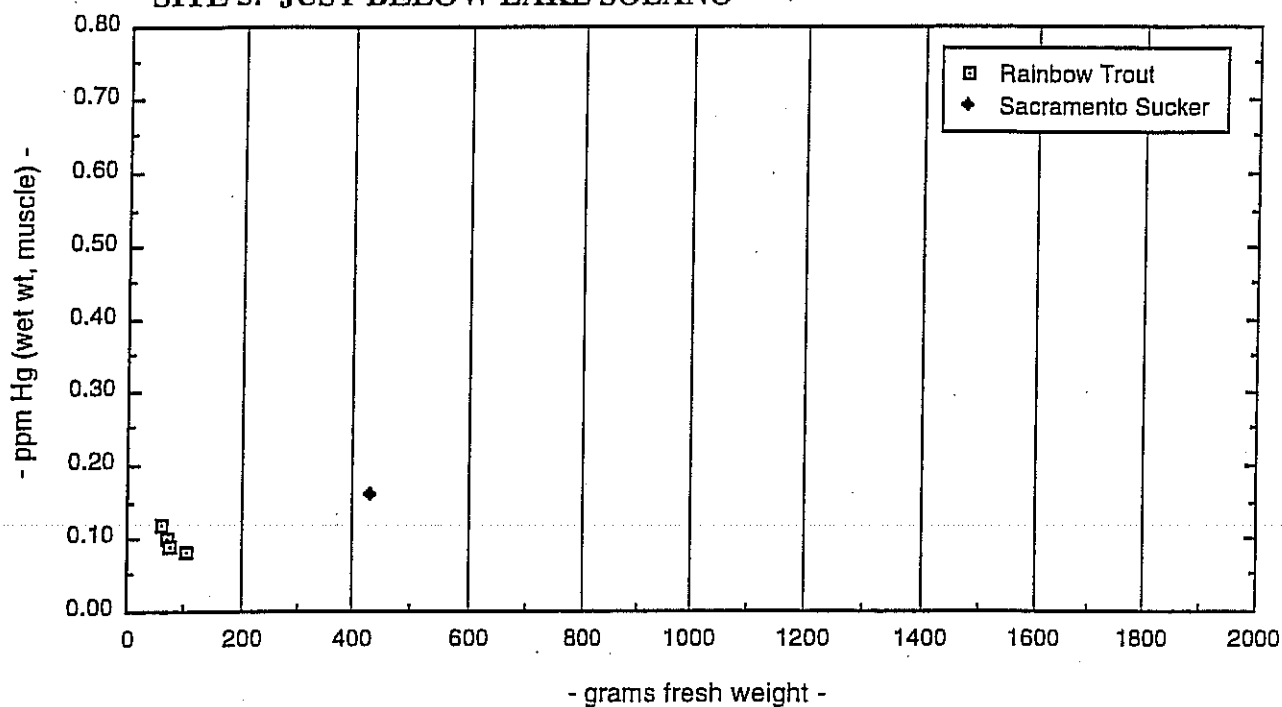


Fig. 3(d) Fish muscle mercury
SITE 4: BELOW WINTERS AT HIGHWAY 505

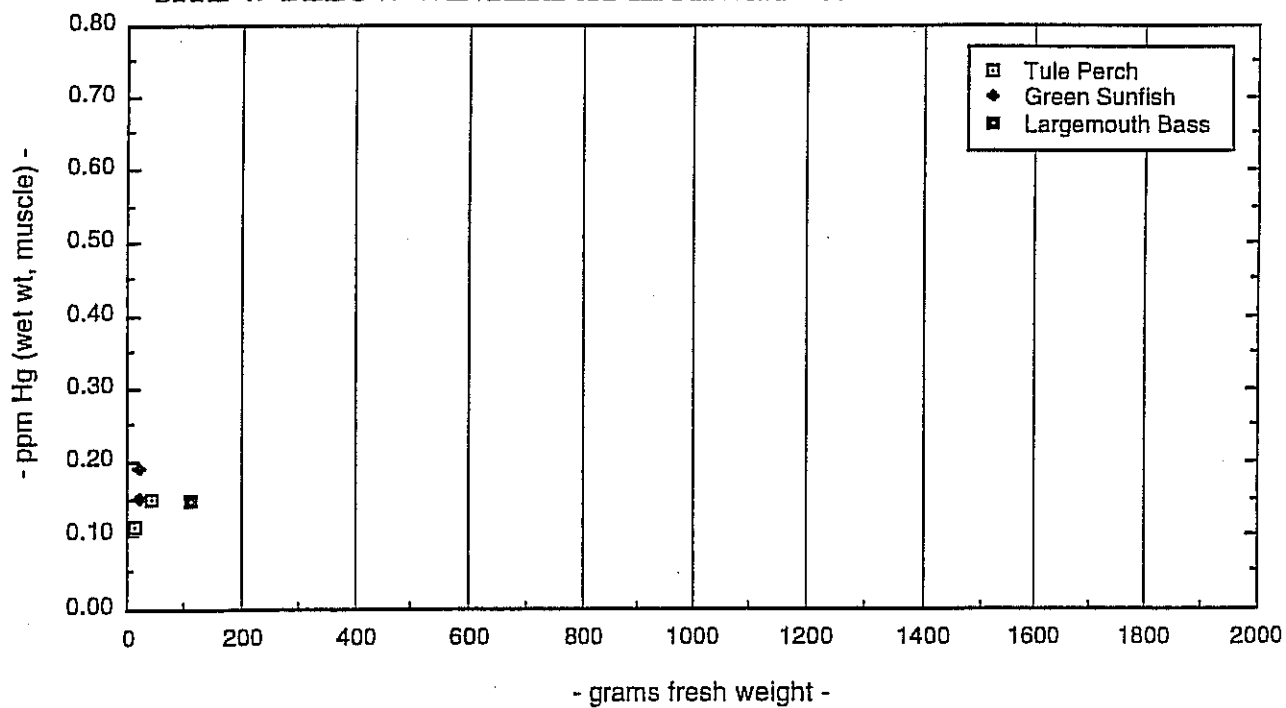


Fig. 3(g) Fish muscle mercury

SITE 9: 0.5-1.0 MILE BELOW LEHR (Fish $\leq 2,000$ g)

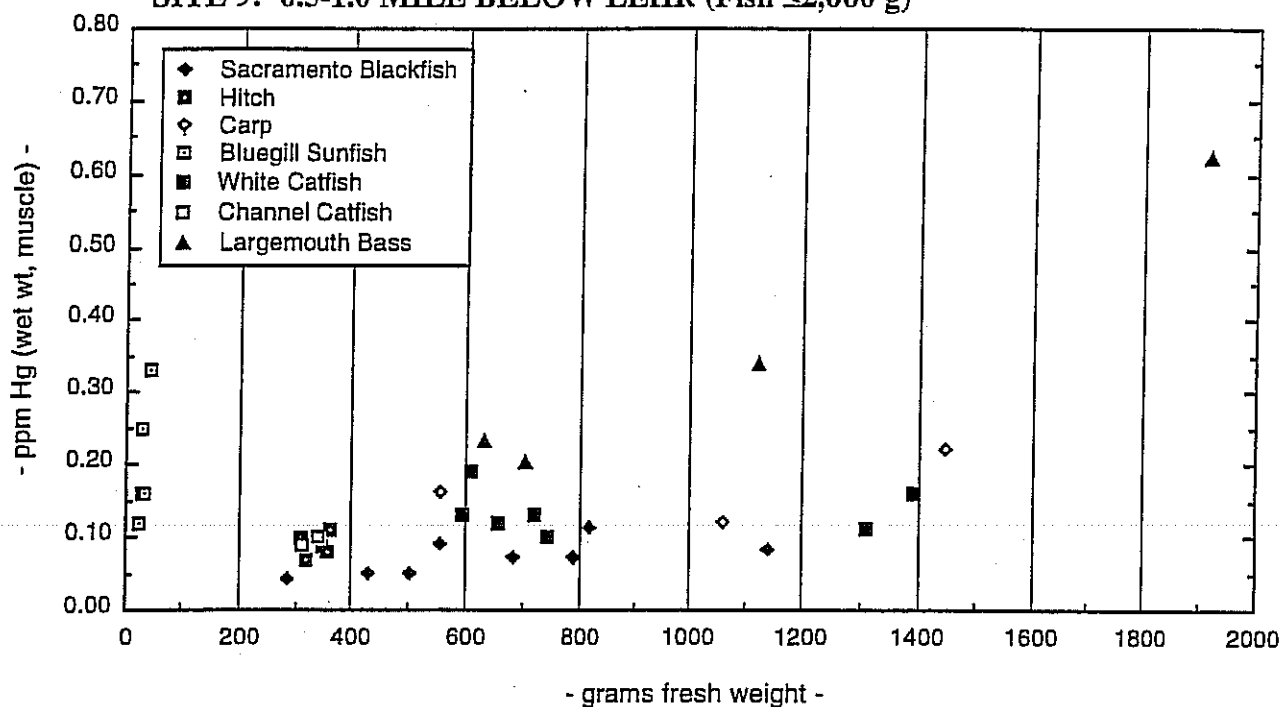


Fig. 4(a)
RAINBOW TROUT

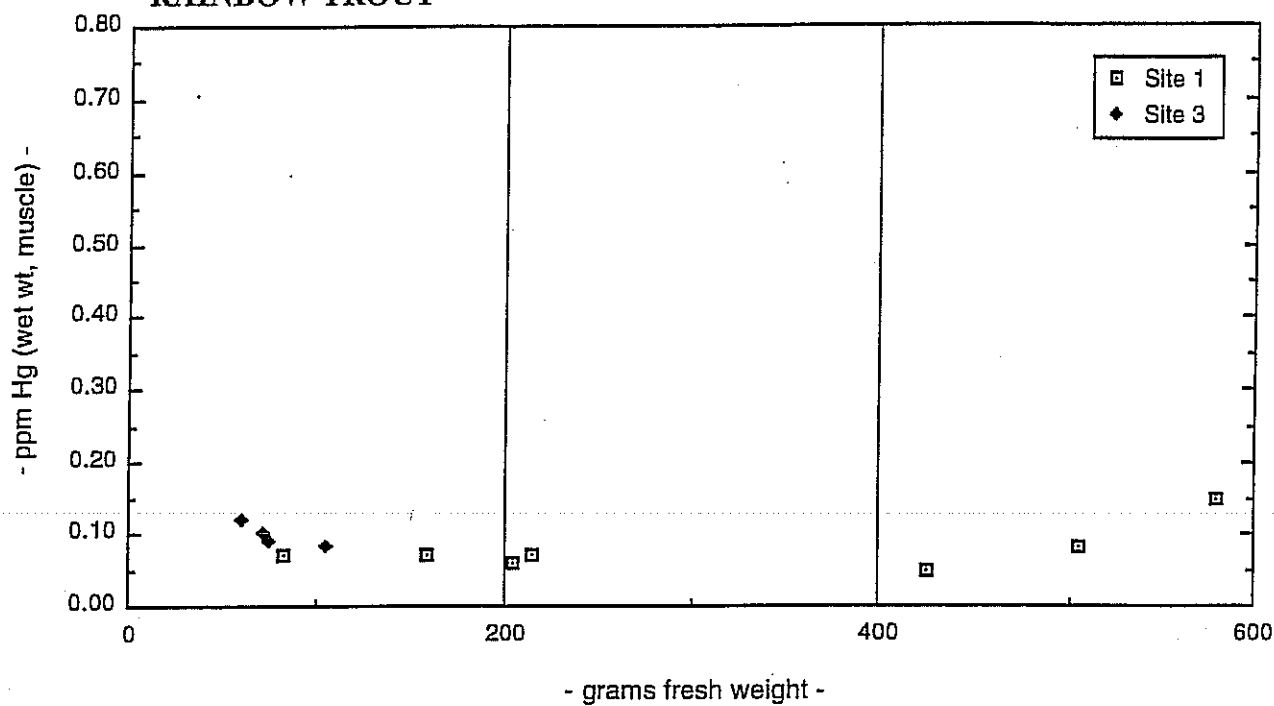


Fig. 4(b)
HITCH

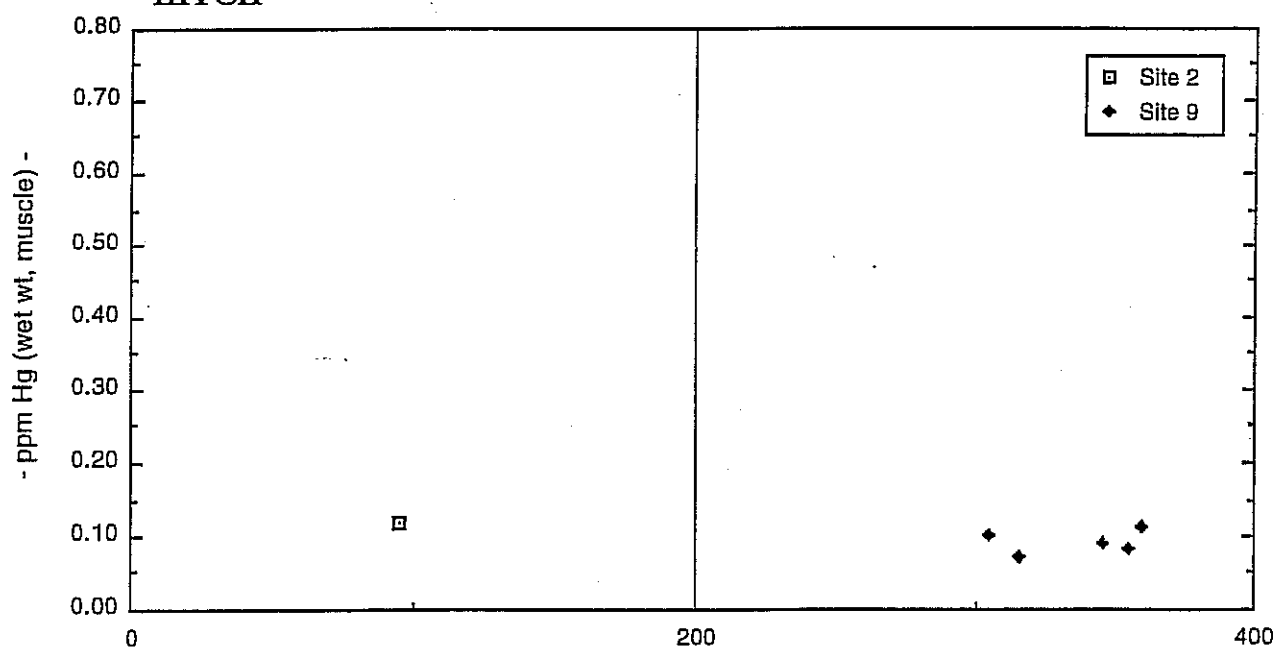


Fig. 4(e)
CARP

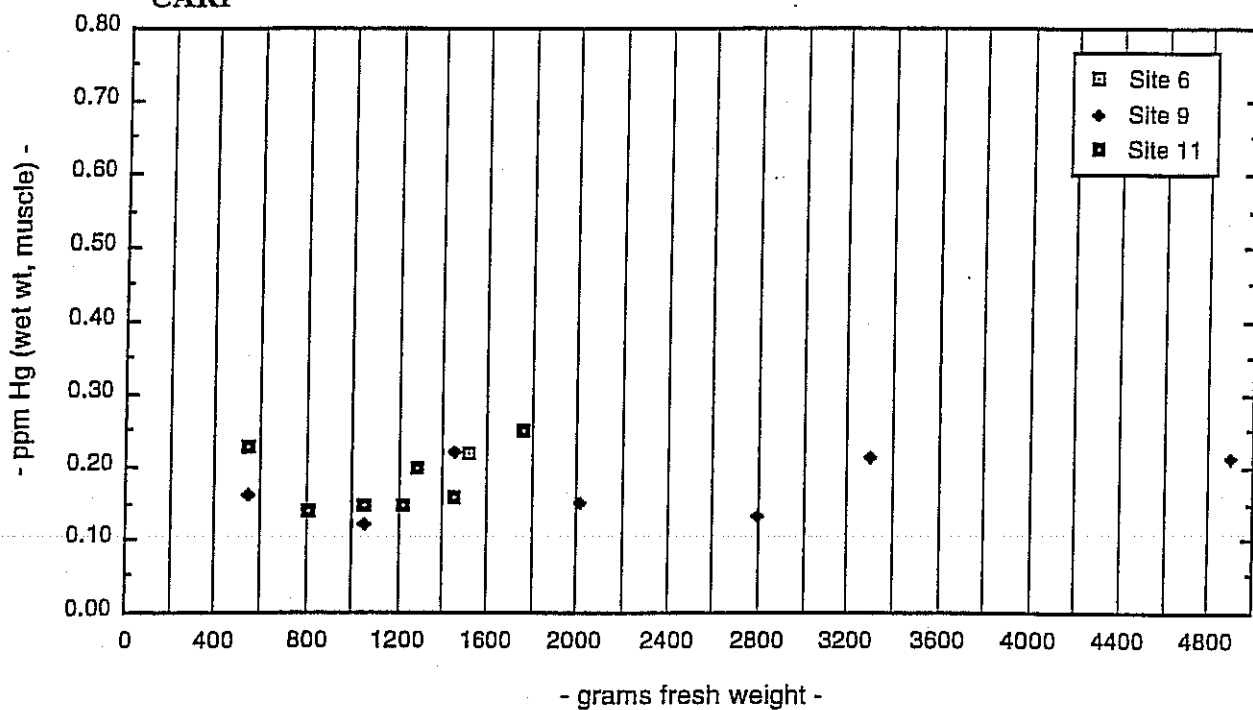


Fig. 4(f)
SUNFISH

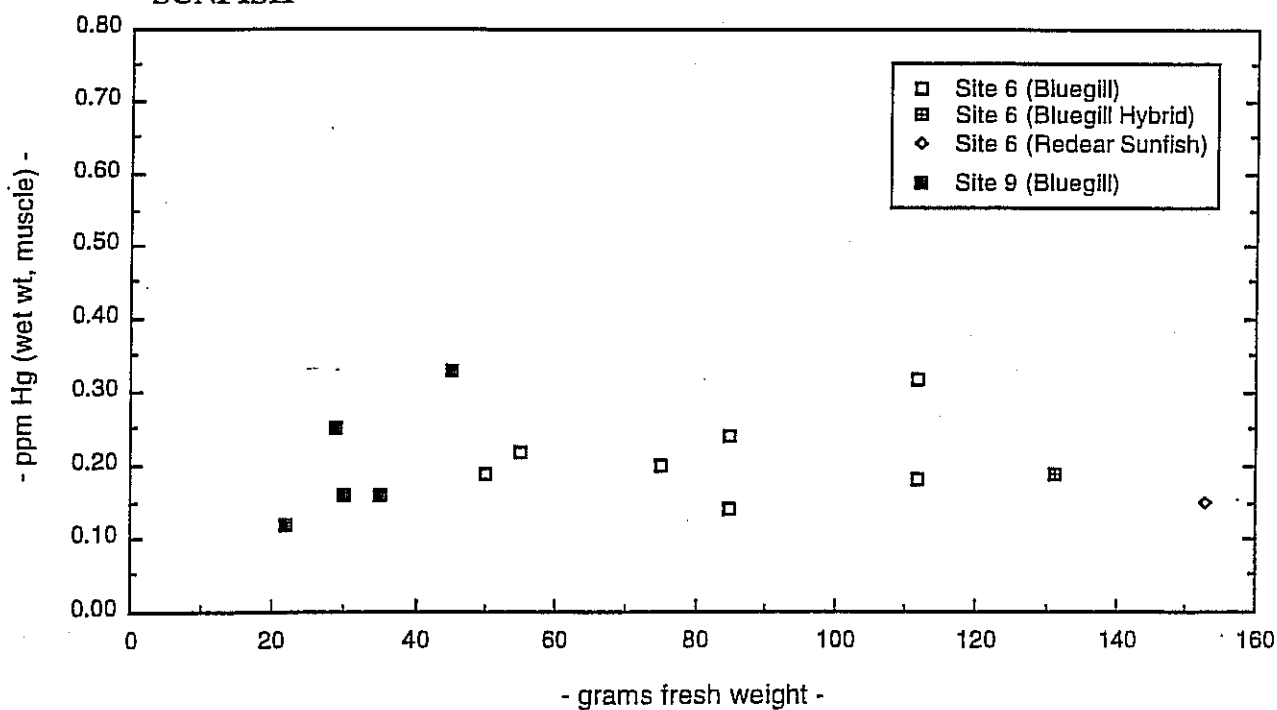


Fig. 4(i)
CRAPPIE

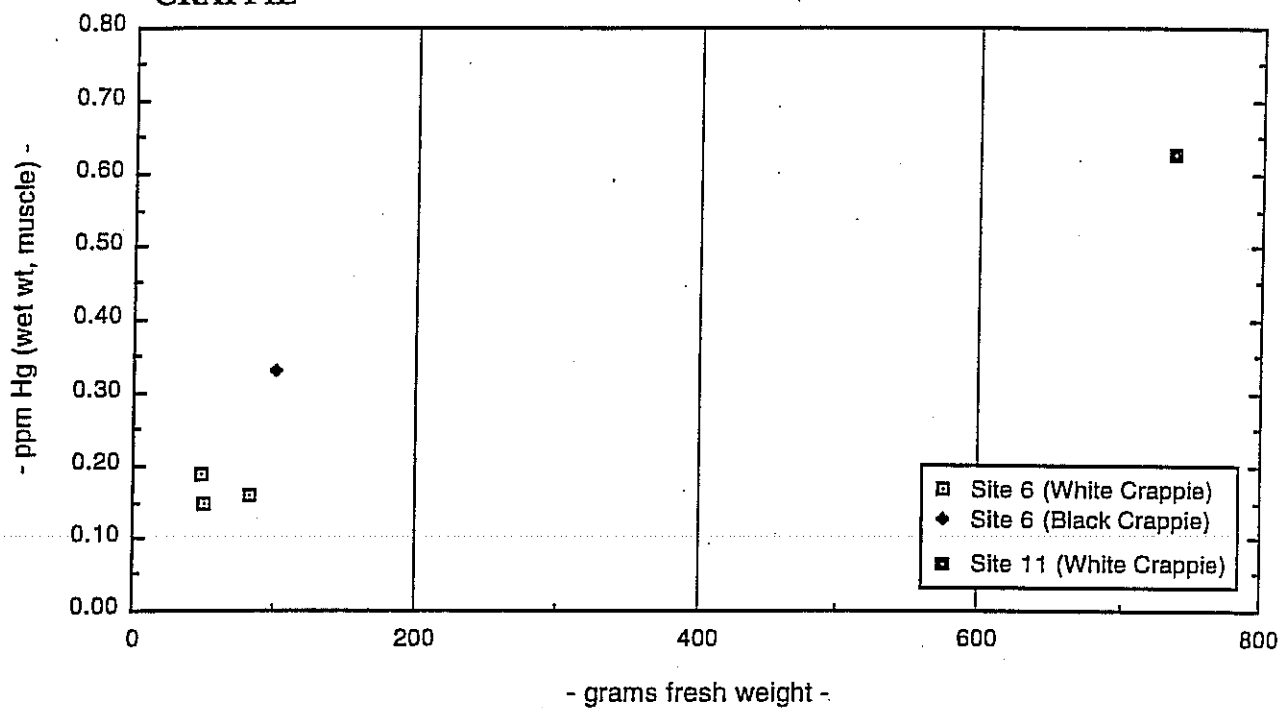
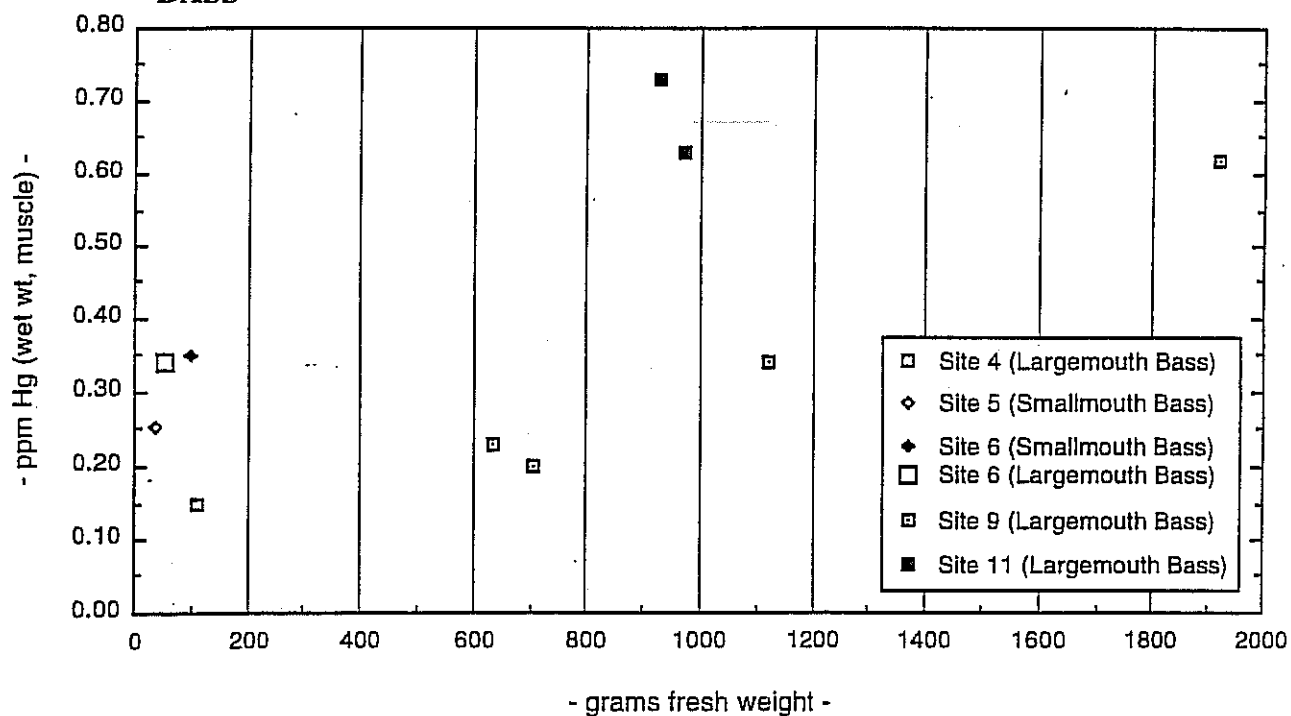


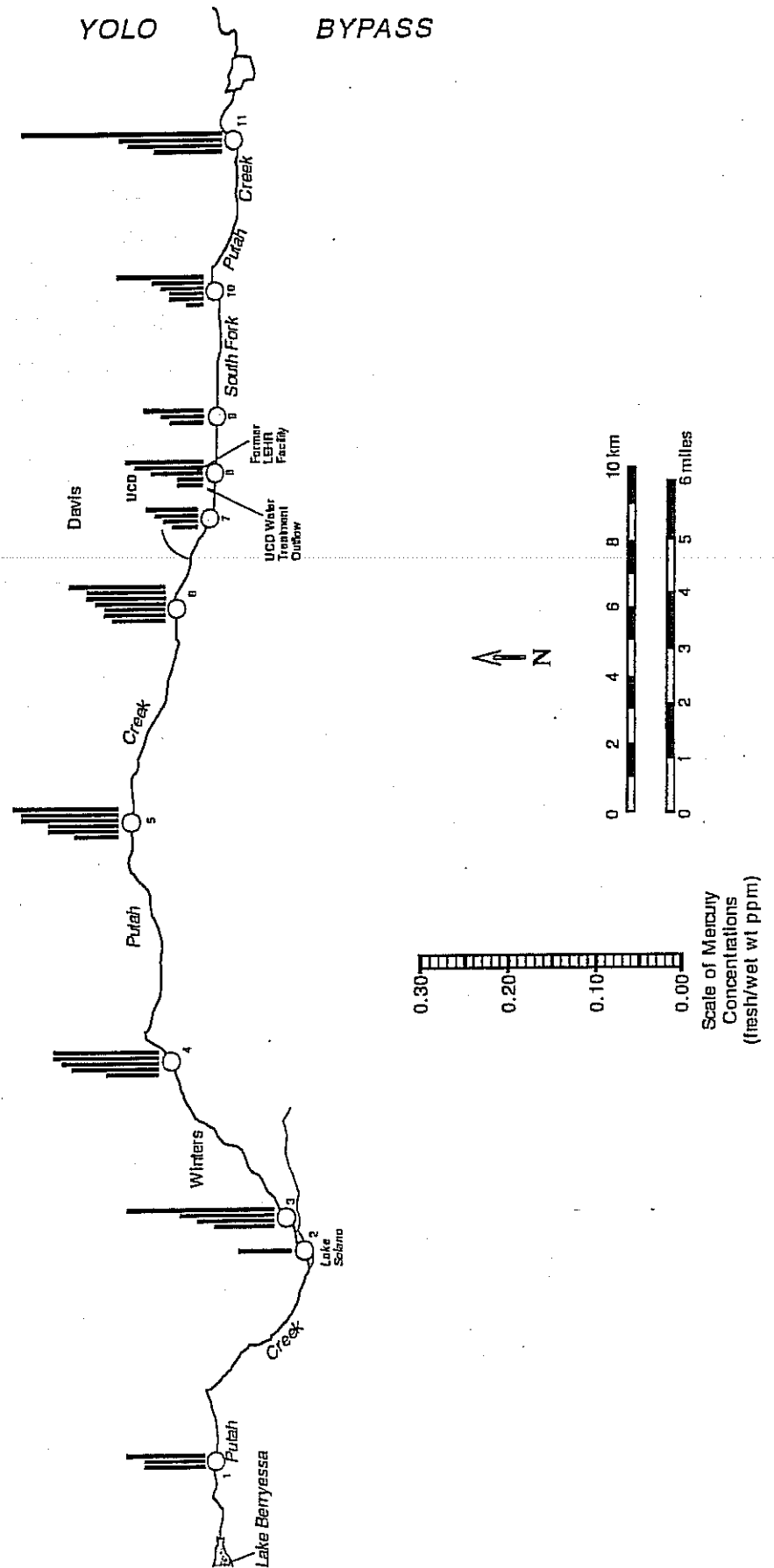
Fig. 4(j)
BASS



sites, Mississippi silverside--0.12 ppm vs 0.06-0.10 ppm at 5 other sites, red shiner--0.08 ppm vs 0.02-0.03 at 3 other sites, and mosquitofish—most anomalous at 0.23 ppm vs 0.03-0.08 ppm at 5 other sites.

The remaining 43 composite samples all contained mercury within the relatively narrow range of 0.02-0.12 ppm. Some of the lowest levels for a variety of species were found at Sites 7-10, located between a half mile upstream and 3 miles downstream of the UC Davis wastewater treatment plant outfall and the LEHR site. Higher mercury was seen upstream of these areas for logperch, bullfrog tadpoles, juvenile bluegill, and mosquitofish. Silversides were similar in both regions. The juvenile and small fish data indicate that the region adjacent to and within 3 miles downstream of the University had reduced levels of biological mercury exposure and uptake, relative to upstream sites. The data also indicate that enhanced exposure/uptake was associated with the furthest downstream site (Site 11) and, to a lesser extent, possibly at the site immediately below Lake Solano (Site 3).

Figure 5. Lower Putah Creek Juvenile and Small Fish Composite Mercury
(each bar represents data for an individual species at each site)
(multi-individual, whole fish composites; data in fresh/wet weight ppm Hg)



no comparable samples were available from downstream sites. In contrast, Hydropsychid caddisflies were the most consistently available of all the aquatic insect samples, and this data set provides the best relative information among the insects for spatial variation in mercury exposure/uptake along the creek. Mercury was quite similar among all the caddisfly samples, ranging between 0.04 and 0.12 ppm. Highest concentrations were found at Sites 1, 3, and 5, located in the upper and middle sections of the creek. A caddisfly sample was obtained from three miles downstream of UC Davis near Mace Rd (Site 10). This sample, at 0.08 ppm, indicated no relative elevation. 0.08 ppm Hg was the mean level in caddisfly larvae from all seven sites where they were sampled.

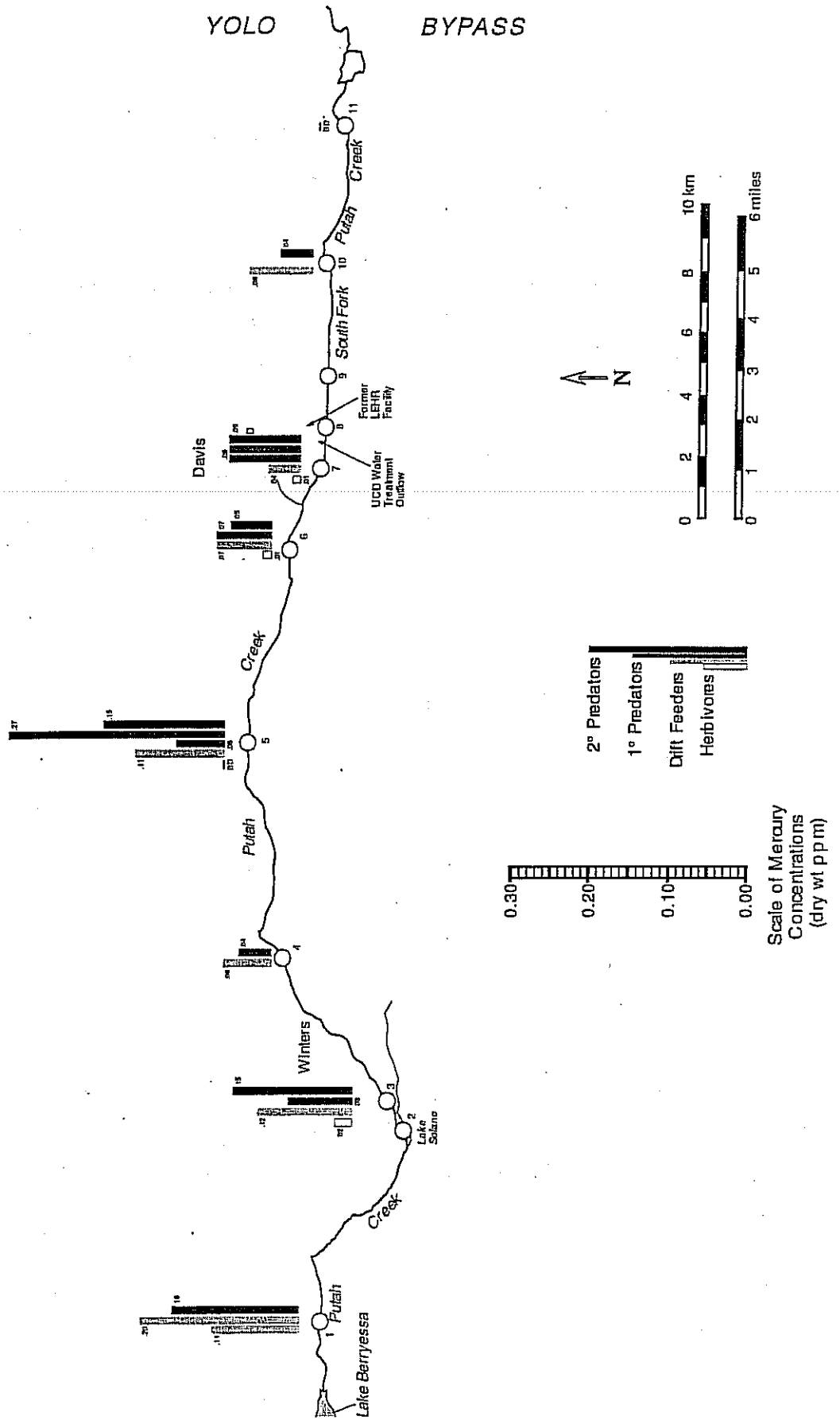
"First order" (small prey) predators, typically represented by stonefly nymphs in headwater reaches, were not consistently available for flow-based kick-screen collection within the study region, primarily due to habitat changes throughout the stretch. Seven adequate composite samples were taken among five of the sites. These came from four different families: Perlodid stonefly nymphs (Site 1), Coenagrionid (Site 7) and Calopterygid (Sites 4, 5, and 7) damselfly nymphs, and Sialid alderflies which are small megalopterans (Sites 3 and 5). Damselfly mercury ranged from 0.04 to 0.09 ppm, with the highest levels, identical in both species at 0.09 ppm, at Site 7, upstream of the UC Davis water treatment outfall and the LEHR site. Small Perlodid stoneflies were collected only at the most upstream site (Site 1). These were apparently somewhat elevated at 0.16 ppm, though comparable samples were not present downstream. Sialid alderfly nymphs contained 0.08 ppm Hg at Site 3 below Lake Solano and exhibited an anomalously elevated level (0.27 ppm) at Russell Ranch (Site 5).

"Second order" (larger prey) predators, typically represented by hellgrammites in headwater reaches, consisted in this study of Tipulid crane fly larvae from Site 3 and Libellulid dragonfly nymphs at Sites 5, 6, 7, and 10. The Site 3 crane fly sample had 0.15 ppm mercury. Libellulid dragonfly nymphs were present both above the university inputs (Sites 5, 6, and 7) and three miles downstream at Site 10. Highest dragonfly mercury was found at Russell Ranch (Site 5, 0.15 ppm). Sites 6 and 7 had relatively lower levels of 0.07 and 0.09 ppm, and Site 10 below the University had the lowest level, at 0.04 ppm.

Similar, comparative data exist for aquatic insect mercury bioindicator organisms throughout California from our various projects, already cited. The levels summarized in Table 5 are not notably elevated for this region of California. Dramatically higher concentrations are typical closer to mining-related sources of mercury, both in the Coast Range and in the Sierra Nevada. As indicators, though, of relative levels of exposure or biological uptake between sites, these Putah Creek collections indicate no elevation in relation to potential University inputs.

Figure 6. Lower Putah Creek Aquatic Insect Mercury

(each bar represents data for an individual species at each site, keyed to family)
(multi-individual, whole body composites; data in dry weight ppm Hg)



Hwy 505: 0.16 ppm). This was in spite of the fact that the mean sizes of the sampled individuals increased moving downstream. Mercury levels in individual *Pacifasticus* varied between 0.08 and 0.61 ppm. Signal crayfish were not present in the creek at Sites 5-11; thus, inter-site comparisons using this species can only be made among upstream Sites 1-4. We hypothesize that the elevated, variable concentrations from upstream Site 1 may indicate consumption by some of the *Pacifasticus* of highly mercury-elevated Sacramento suckers which make upstream spawning runs out of Lake Solano.

Louisiana swamp crayfish (*Procambarus*) contained mercury in a range considerably lower than that found upstream in samples of *Pacifasticus*. Individual *Procambarus* mercury ranged between 0.05 and 0.28 ppm, with site means ranging between 0.10 and 0.19 ppm. Within this relatively narrow range, highest levels were seen at Site 9 (0.7 miles downstream of UC Davis, 0.19 ppm), Site 10 (3 miles downstream of UC Davis, 0.16 ppm), and Site 6 (upstream of the University at Pedrick Rd, 0.15 ppm). The individuals taken at Sites 9 and 10 were, on average, considerably larger than *Procambarus* taken at other sites. Lowest mean levels were found at Site 5 (Russell Ranch, 0.10 ppm), Site 8 (directly adjacent to the LEHR site and downstream of the UC Davis wastewater treatment outfall, 0.12 ppm), and at the most downstream site (Site 11 at Rd 106A, 0.13 ppm). These data indicate no significant locational trend in mercury exposure/uptake between Sites 5 and 11.

The third species, *Orconectes*, was notable in containing considerably higher mercury concentrations than *Procambarus* at the sites where both species occurred. This was a consistent phenomenon, with *Orconectes* mercury typically 2-3 times greater than the levels seen in co-occurring *Procambarus*. The probable explanation is that these species, while both being bottom feeding omnivores with very similar body types and physiology, must to some extent partition the food resources at the sites where they overlap. The data suggest that *Orconectes* consume more high trophic level (animal) food on average, while the *Procambarus* diet may contain a substantial fraction of low trophic level (plant-based) food items. Mercury in individual *Orconectes* ranged between 0.18 and 0.52 ppm. Mean levels were highest and similar at Site 5 (Russell Ranch, 0.35 ppm), Site 6 (upstream of the University at Pedrick Rd, 0.32 ppm), and Site 9 (0.7 miles downstream of UC Davis, 0.33 ppm). Lowest *Orconectes* mercury was sampled at Site 8 (adjacent to the LEHR site and downstream of the UC Davis water treatment outfall, 0.22 ppm), and at the most downstream site (Site 11 at Rd 106A, 0.27 ppm). Similar to the *Procambarus* data, these relative concentrations indicate no significant locational trend in mercury exposure/uptake between Sites 5 and 11.

Table 6. Putah Creek Individual Crayfish Tail Muscle Mercury Data. (continued)

| Site # | Site Description | Crayfish Species | Weight (g) | Carapace | Muscle Hg (wet wt ppm) |
|--------|---------------------|--------------------|------------|-------------|------------------------|
| | | | | Length (mm) | |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓31 | 8.9 | 0.05 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓37 | 11.4 | 0.06 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓45 | 20.0 | 0.12 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓43 | 17.0 | 0.13 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓45 | 18.9 | 0.28 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓45 | 25.6 | 0.12 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓49 | 26.2 | 0.22 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓50 | 25.1 | 0.17 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | ✓53 | 43.2 | 0.17 |
| 6 | At Pedrick Rd | <i>Orconectes</i> | ✓31 | 8.8 | 0.18 |
| 6 | At Pedrick Rd | <i>Orconectes</i> | ✓43 | 26.0 | 0.45 |
| 8 | At LEHR/UCD | <i>Procambarus</i> | ✓41 | 20.2 | 0.10 |
| 8 | At LEHR/UCD | <i>Procambarus</i> | ✓43 | 27.2 | 0.10 |
| 8 | At LEHR/UCD | <i>Procambarus</i> | ✓45 | 22.6 | 0.10 |
| 8 | At LEHR/UCD | <i>Procambarus</i> | ✓48 | 32.1 | 0.14 |
| 8 | At LEHR/UCD | <i>Procambarus</i> | ✓54 | 35.4 | 0.10 |
| 8 | At LEHR/UCD | <i>Procambarus</i> | ✓48 | 28.5 | 0.18 |
| 8 | At LEHR/UCD | <i>Procambarus</i> | ✓52 | 31.7 | 0.14 |
| 8 | At LEHR/UCD | <i>Orconectes</i> | ✓47 | 39.4 | 0.26 |
| 8 | At LEHR/UCD | <i>Orconectes</i> | ✓48 | 35.7 | 0.19 |
| 8 | At LEHR/UCD | <i>Orconectes</i> | ✓47 | 36.7 | 0.22 |
| 9 | 0.7 mi blw LEHR/UCD | <i>Procambarus</i> | ✓47 | 26.7 | 0.20 |
| 9 | 0.7 mi blw LEHR/UCD | <i>Procambarus</i> | ✓48 | 36.9 | 0.15 |
| 9 | 0.7 mi blw LEHR/UCD | <i>Procambarus</i> | ✓50 | 39.5 | 0.20 |
| 9 | 0.7 mi blw LEHR/UCD | <i>Procambarus</i> | ✓55 | 36.5 | 0.19 |
| 9 | 0.7 mi blw LEHR/UCD | <i>Orconectes</i> | ✓48 | 39.3 | 0.31 |
| 9 | 0.7 mi blw LEHR/UCD | <i>Orconectes</i> | ✓48 | 40.2 | 0.36 |
| 10 | At Mace Blvd | <i>Procambarus</i> | ✓46 | 24.8 | 0.14 |
| 10 | At Mace Blvd | <i>Procambarus</i> | ✓51 | 39.1 | 0.14 |
| 10 | At Mace Blvd | <i>Procambarus</i> | ✓48 | 29.8 | 0.19 |
| 10 | At Mace Blvd | <i>Procambarus</i> | ✓49 | 36.2 | 0.17 |
| 10 | At Mace Blvd | <i>Procambarus</i> | ✓52 | 40.7 | 0.17 |
| 11 | At Rd 106A | <i>Procambarus</i> | ✓33 | 9.1 | 0.16 |
| 11 | At Rd 106A | <i>Procambarus</i> | ✓35 | 10.8 | 0.07 |
| 11 | At Rd 106A | <i>Procambarus</i> | ✓40 | 14.5 | 0.10 |
| 11 | At Rd 106A | <i>Procambarus</i> | ✓47 | 25.3 | 0.12 |
| 11 | At Rd 106A | <i>Procambarus</i> | ✓49 | 27.5 | 0.18 |
| 11 | At Rd 106A | <i>Procambarus</i> | ✓56 | 43.2 | 0.12 |
| 11 | At Rd 106A | <i>Orconectes</i> | ✓42 | 24.7 | 0.27 |

Table 7. Putah Creek Crayfish Tail Muscle Mercury: Reduced Data. (continued)
(B) Sorted by Species

| Site # | Site Description | Crayfish Species | n | ----- (mean values \pm std. deviation) ----- | | | 95% Confid. Int. of mean Hg (wet wt ppm) |
|------------|---------------------|---------------------|----|--|-----------------|------------------------|--|
| | | | | Weight (g) | Length (mm) | Muscle Hg (wet wt ppm) | |
| BY SPECIES | | | | | | | |
| 1 | Below L. Berryessa | <i>Pacifasticus</i> | 10 | 45.0 \pm 8.8 | 38.2 \pm 26.8 | 0.341 \pm 0.162 | 0.225 - 0.457 |
| 2 | In Lake Solano | <i>Pacifasticus</i> | 5 | 44.4 \pm 7.5 | 35.0 \pm 16.9 | 0.229 \pm 0.038 | 0.182 - 0.276 |
| 3 | Below L. Solano | <i>Pacifasticus</i> | 8 | 50.3 \pm 6.5 | 46.3 \pm 15.9 | 0.201 \pm 0.076 | 0.137 - 0.265 |
| 4 | Below Winters | <i>Pacifasticus</i> | 7 | 55.6 \pm 7.0 | 62.7 \pm 27.6 | 0.156 \pm 0.070 | 0.092 - 0.220 |
| 5 | At Russell Ranch | <i>Procambarus</i> | 4 | 44.0 \pm 10.2 | 21.8 \pm 12.4 | 0.101 \pm 0.029 | 0.055 - 0.147 |
| 6 | At Pedrick Rd | <i>Procambarus</i> | 9 | 44.2 \pm 6.7 | 21.8 \pm 10.1 | 0.149 \pm 0.073 | 0.093 - 0.205 |
| 8 | At LEHR/UCD | <i>Procambarus</i> | 7 | 47.3 \pm 4.7 | 28.2 \pm 5.4 | 0.124 \pm 0.032 | 0.094 - 0.153 |
| 9 | 0.7 mi blw LEHR/UCD | <i>Procambarus</i> | 4 | 50.0 \pm 3.6 | 34.9 \pm 5.6 | 0.186 \pm 0.023 | 0.150 - 0.222 |
| 10 | At Mace Blvd | <i>Procambarus</i> | 5 | 49.2 \pm 2.4 | 34.1 \pm 6.7 | 0.160 \pm 0.023 | 0.131 - 0.189 |
| 11 | Below Rd 106A | <i>Procambarus</i> | 6 | 43.3 \pm 8.9 | 21.7 \pm 12.9 | 0.125 \pm 0.041 | 0.082 - 0.168 |
| 5 | At Russell Ranch | <i>Orconectes</i> | 7 | 42.6 \pm 2.8 | 27.1 \pm 5.6 | 0.353 \pm 0.123 | 0.240 - 0.467 |
| 6 | At Pedrick Rd | <i>Orconectes</i> | 2 | 37.0 \pm 8.5 | 17.4 \pm 12.2 | 0.318 \pm 0.191 | (0.318) |
| 8 | At LEHR/UCD | <i>Orconectes</i> | 3 | 47.3 \pm 0.6 | 37.3 \pm 1.9 | 0.222 \pm 0.037 | 0.130 - 0.313 |
| 9 | 0.7 mi blw LEHR/UCD | <i>Orconectes</i> | 2 | 48.0 \pm 0.0 | 39.8 \pm 0.6 | 0.334 \pm 0.038 | (0.334) |
| 11 | Below Rd 106A | <i>Orconectes</i> | 1 | 42.0 | 24.7 | 0.270 | (0.270) |

Fig. 7(c) Crayfish
SITE 3: JUST BELOW LAKE SOLANO

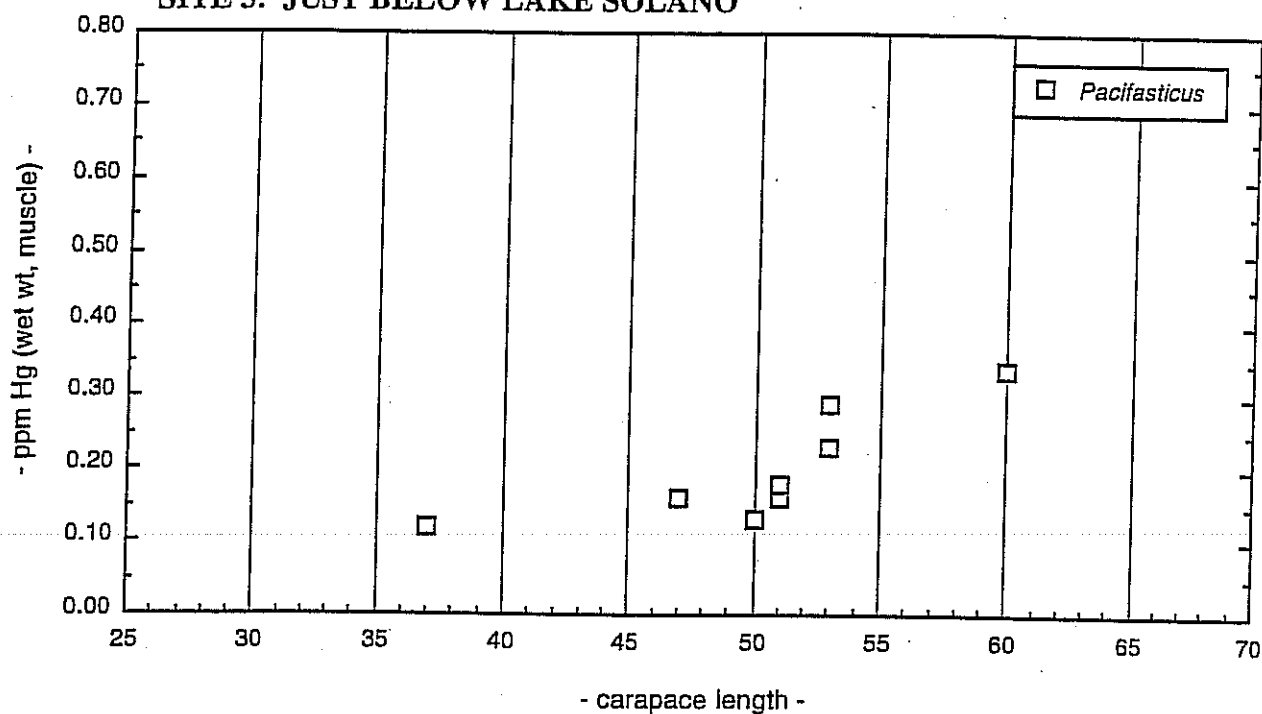


Fig. 7(d) Crayfish
SITE 4: BELOW WINTERS AT HIGHWAY 505

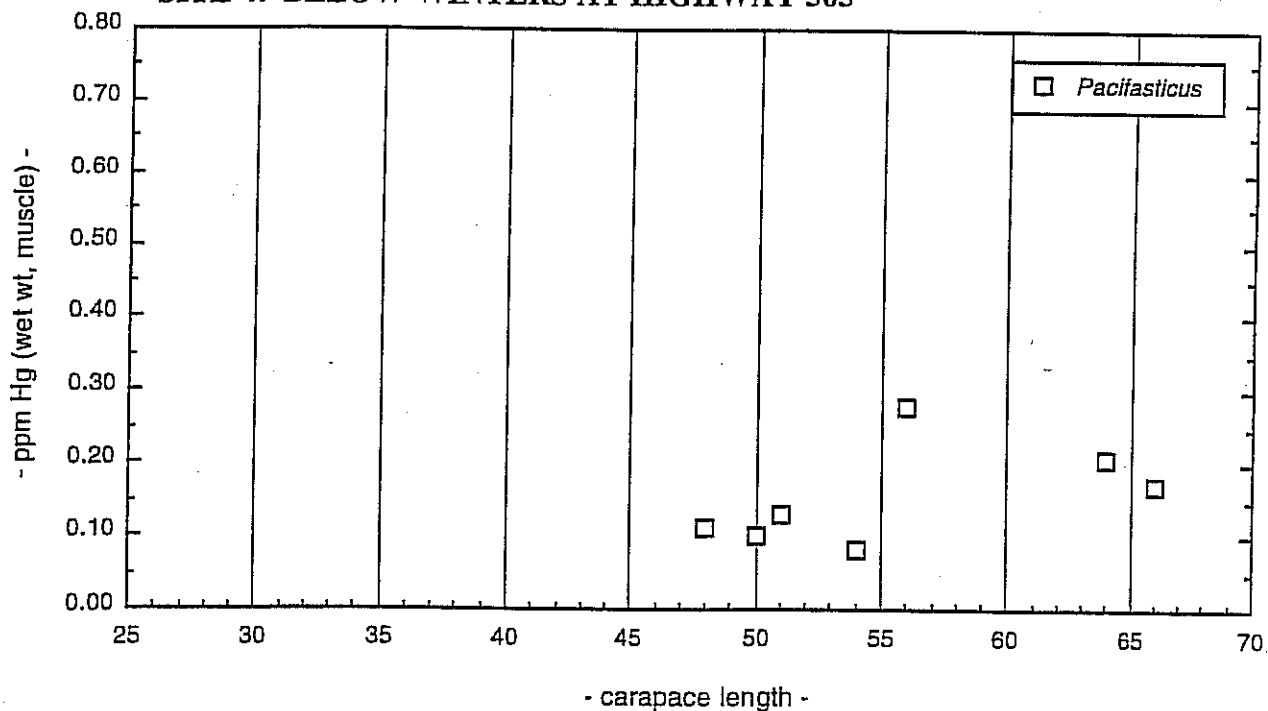


Fig. 7(g) Crayfish

SITE 8: ADJACENT TO LEHR SITE, BELOW OLD DAVIS RD

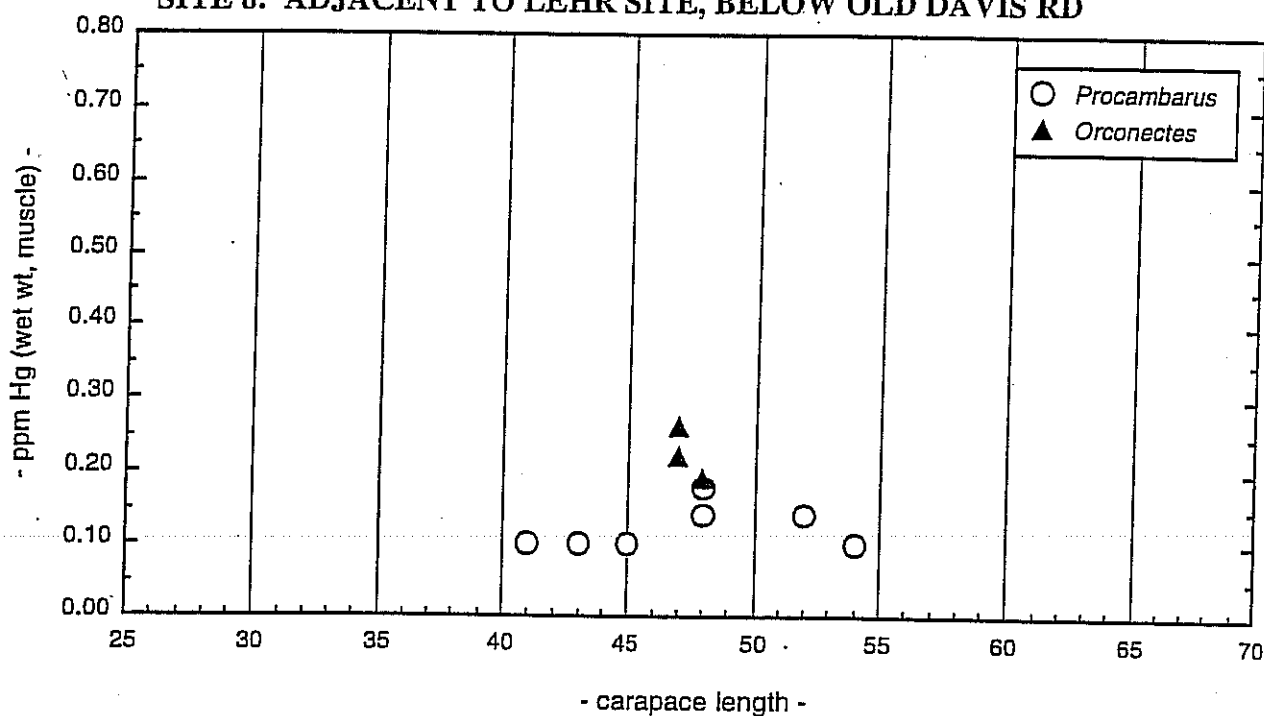


Fig. 7(h) Crayfish

SITE 9: 0.7 MILE DOWNSTREAM OF LEHR SITE

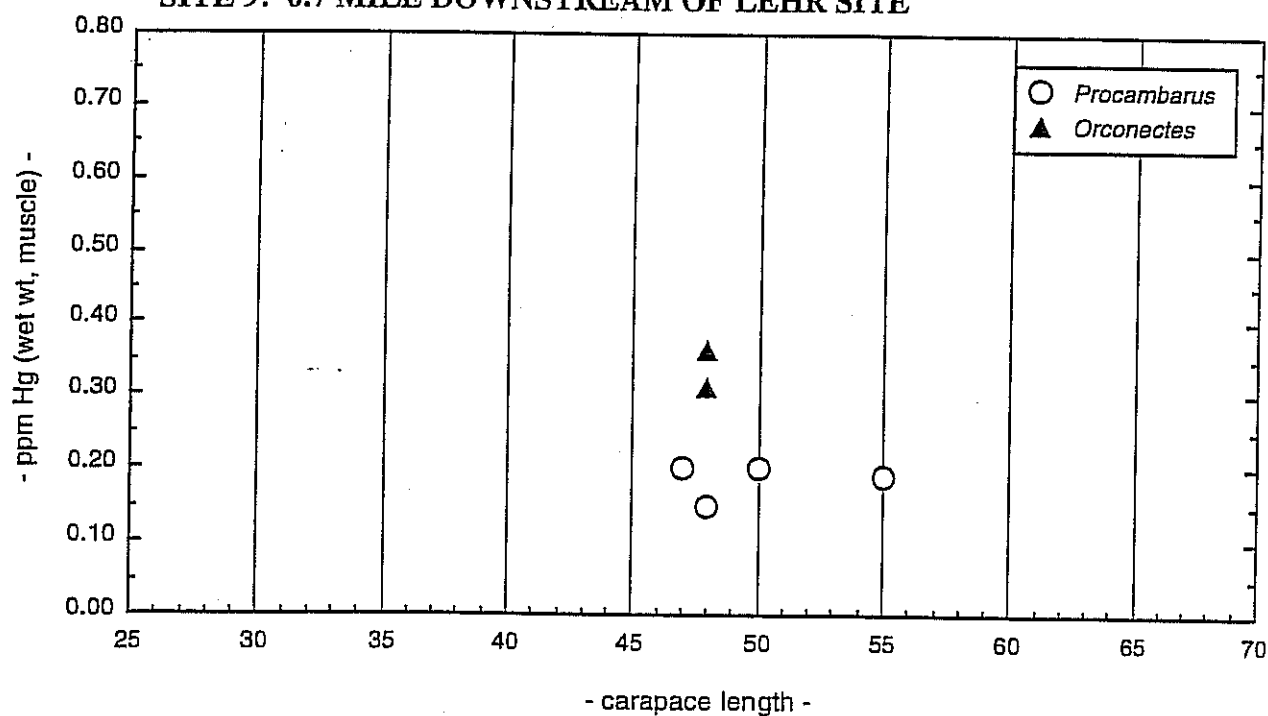


Fig. 8. Putah Creek Reduced (Mean) Crayfish Mercury Data Across the Range of Sampling Sites
(means \pm 95% confidence intervals for multiple individual samples for each site/species)
(fresh/wet weight mercury concentrations in tail muscle)

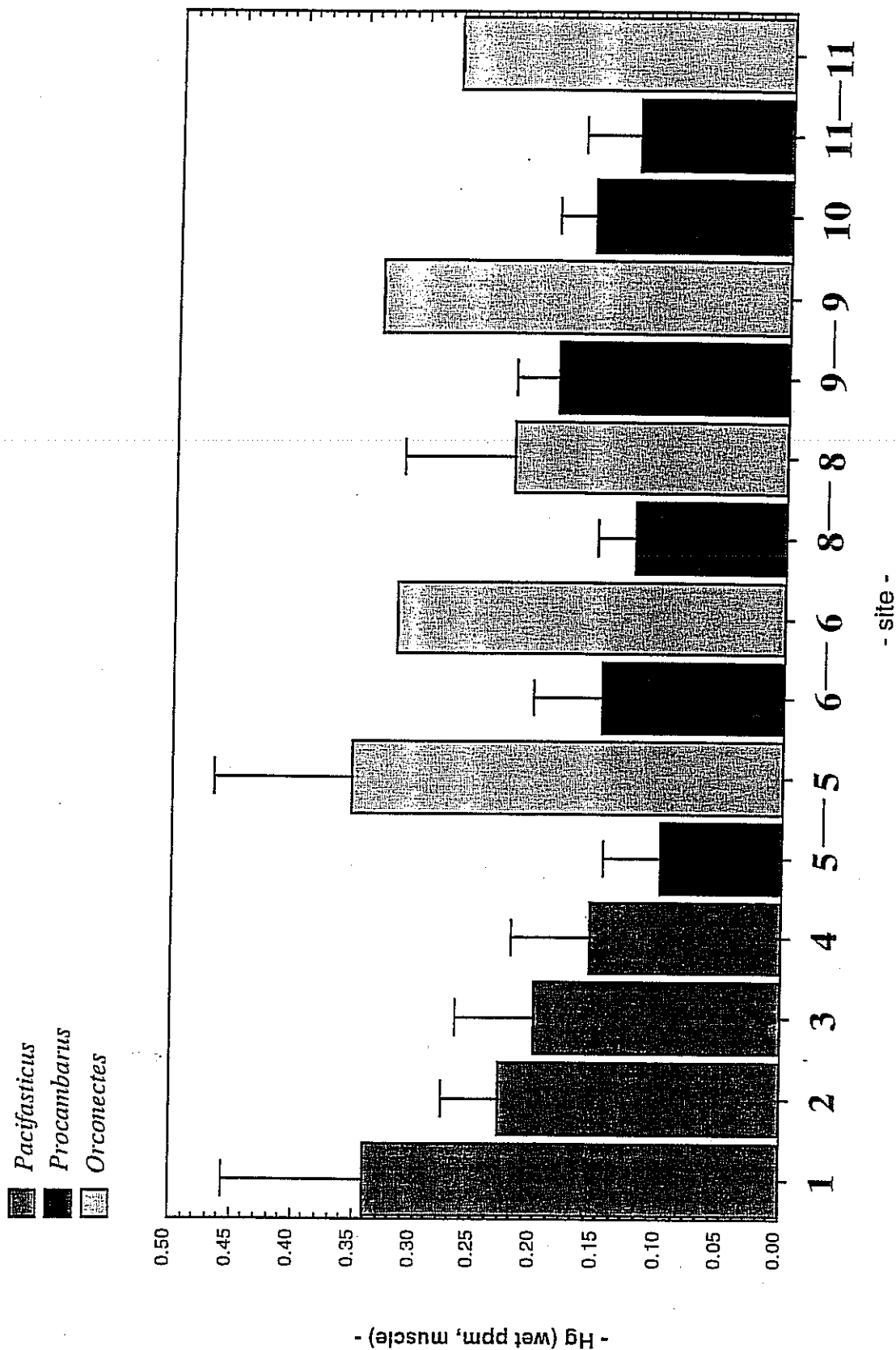
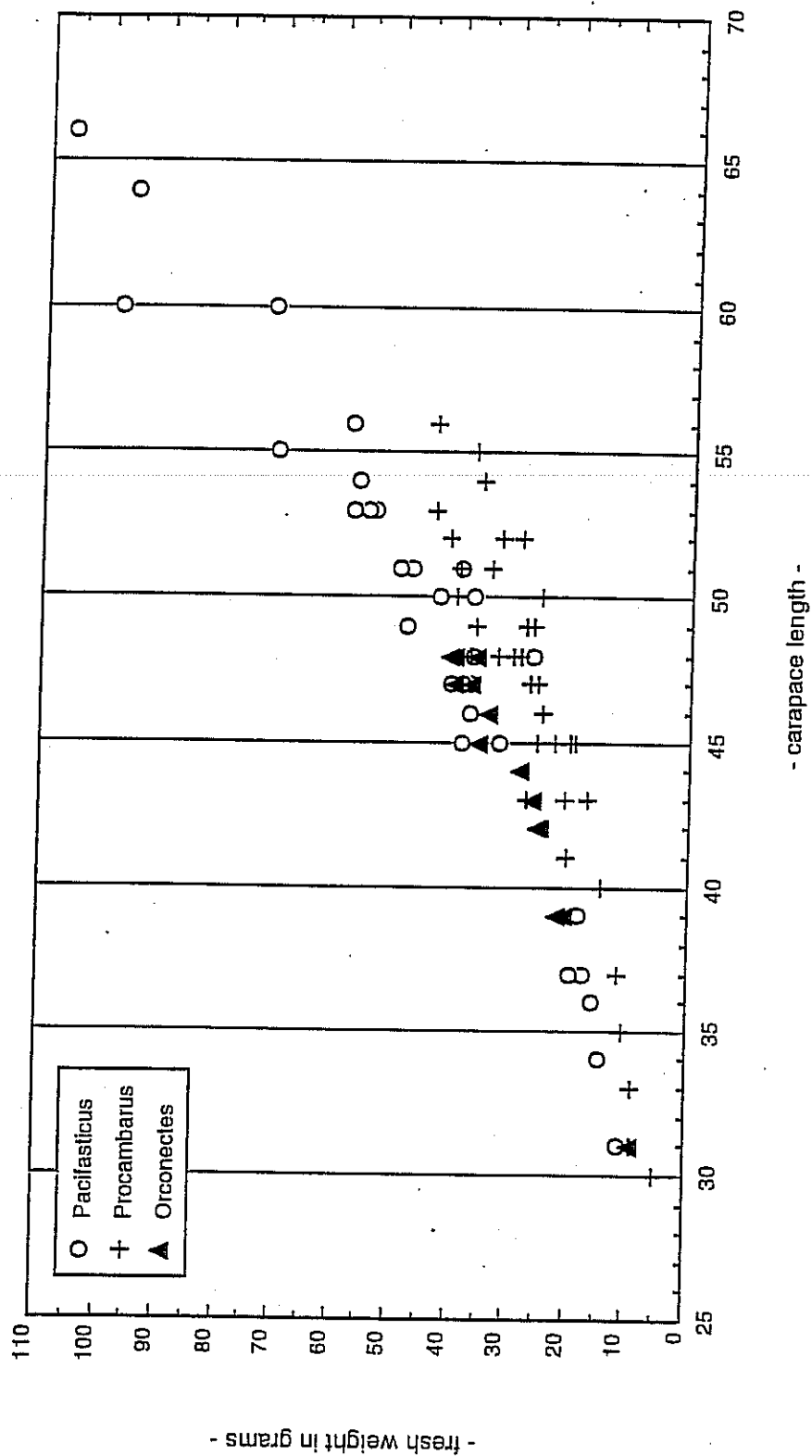


Fig. 10
Carapace Length : Body Weight Relations
For The Three Putah Creek Crayfish Species



stretches were also present between the UC Davis wastewater treatment outflow and Sites 8, 9, and 10. The relatively unchanged or lower mercury contents of bioindicator organisms from those sites indicate that this outflow does not have a major effect on mercury dynamics in the creek. It is possible that relatively enhanced levels of mercury methylation may occur at Site 11 downstream and that this may be partially related to the presence of surface-covering mats of water hyacinth plants there, which may promote local anoxic zones either in the water column or at the bottom when the plants die and sink. Nutrients from the University outflow may contribute somewhat to the hyacinth growth, though the entire creek below Lake Berryessa is high in nutrients.

Biotic mercury accumulations found in this Putah Creek study were similar to and somewhat lower than those found in research conducted on the lower portion of Cache Creek (Slotton *et al.* 1997c). Aquatic insect mercury concentrations from lower Putah Creek were considerably lower than levels seen in comparable organisms in the upstream watersheds of both Cache Creek (Reuter *et al.* 1996, 1998, Slotton *et al.* 1997b) and Putah Creek (study in progress). It is clear to us that the predominant source of bioavailable mercury in both watersheds can be traced to historic mercury mining and now-abandoned mercury mines. Cache Creek, which remains un-dammed below Clear Lake and Indian Valley Reservoir, is currently believed to be the single most significant conduit of mercury to the San Francisco Bay-Delta. A very intensive, multi-investigator research project is being developed at this time for the State, to study this phenomenon and the possibilities for cost-effective remediation of key mine-related sources (Stephenson *et al.* 1999).

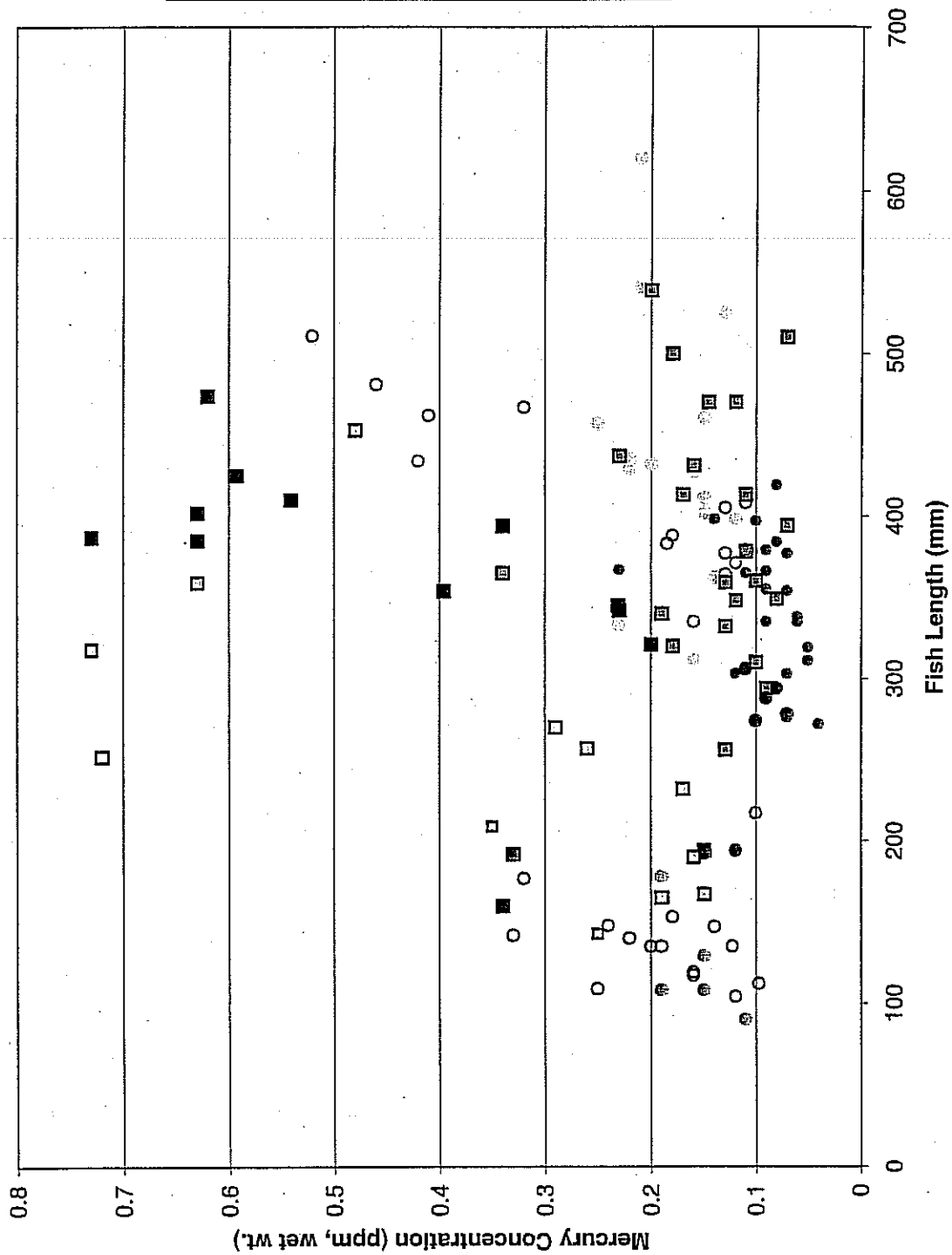
While Lake Berryessa now lies between the lower portion of Putah Creek and upstream historic mercury mining zones, it is important to note that the dam and reservoir were not present throughout the period of active mining in the late 19th and early to mid 20th centuries. Figure 11 shows some of the more important mercury mines in the upper Putah watershed, including the Oat Hill Mine, second largest in all of California and largest in Northern California. Historic mercury production in the Putah Creek watershed was more than double that in the Cache Creek watershed (USDCMG 1997). Before Monticello Dam was built in the 1950s, Putah Creek undoubtedly constituted at least as great of a "mercury conduit" as present day Cache Creek. While the ongoing downstream transport of this material may have been greatly diminished by the dam and reservoir, remnant mercury must certainly be present within the stream bed and adjacent banks of lower Putah Creek. This material is re-exposed, transported, and re-distributed during high flow events. The results of this study are consistent with remnant, mining-derived mercury (together with some level of ongoing transfer through Lake Berryessa) constituting the primary source of ongoing mercury contamination in lower Putah Creek.

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Mercury Concentrations in Putah Creek Fish



| Source | Date | Study Location | Location Description | Downstream Order | Species | Composite Description | TL (mm) | Size or Length (mm) | Weight (g) | # of Fish | Hg Conc (ppm, wet) | # of Fish • Conc | Species Mean at Each Location |
|---------|------|----------------|---|------------------|------------------------|---|---------|---------------------|------------|-----------|--------------------|------------------|-------------------------------|
| UCDavis | 1998 | 1 | Putah Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 337 | 425 | 1 | 0.05 | 0.05 | 0.079 |
| UCDavis | 1998 | 1 | Putah Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 245 | 205 | 1 | 0.06 | 0.06 | |
| UCDavis | 1998 | 1 | Putah Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 192 | 92 | 1 | 0.07 | 0.07 | |
| UCDavis | 1998 | 1 | Putah Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 225 | 159 | 1 | 0.07 | 0.07 | |
| UCDavis | 1998 | 1 | Putah Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 259 | 215 | 1 | 0.07 | 0.07 | |
| UCDavis | 1998 | 1 | Putah Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 348 | 505 | 1 | 0.08 | 0.08 | |
| UCDavis | 1998 | 1 | Putah Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 393 | 550 | 1 | 0.15 | 0.15 | |
| UCDavis | 1998 | 2 | In Lake Solano. | 2 | Hitch | | 3 | 194 | 95 | 1 | 0.12 | 0.12 | 0.120 |
| UCDavis | 1998 | 2 | In Lake Solano. | 2 | Sacramento Sucker | | 3 | 467 | 1300 | 1 | 0.32 | 0.32 | 0.426 |
| UCDavis | 1998 | 2 | In Lake Solano. | 2 | Sacramento Sucker | | 3 | 492 | 1425 | 1 | 0.41 | 0.41 | |
| UCDavis | 1998 | 2 | In Lake Solano. | 2 | Sacramento Sucker | | 3 | 434 | 1115 | 1 | 0.42 | 0.42 | |
| UCDavis | 1998 | 2 | In Lake Solano. | 2 | Sacramento Sucker | | 3 | 491 | 1600 | 1 | 0.48 | 0.48 | |
| UCDavis | 1998 | 2 | In Lake Solano. | 2 | Sacramento Sucker | | 3 | 511 | 1910 | 1 | 0.52 | 0.52 | |
| UCDavis | 1998 | 3 | Putah Creek downstream of Lake Solano. | 3 | Rainbow Trout | | 3 | 193 | 105 | 1 | 0.08 | 0.08 | 0.098 |
| UCDavis | 1998 | 3 | Putah Creek downstream of Lake Solano. | 3 | Rainbow Trout | | 3 | 195 | 75 | 1 | 0.09 | 0.09 | |
| UCDavis | 1998 | 3 | Putah Creek downstream of Lake Solano. | 3 | Rainbow Trout | | 3 | 189 | 72 | 1 | 0.1 | 0.1 | |
| UCDavis | 1998 | 3 | Putah Creek downstream of Lake Solano. | 3 | Rainbow Trout | | 3 | 166 | 60 | 1 | 0.12 | 0.12 | |
| UCDavis | 1998 | 3 | Putah Creek downstream of Lake Solano. | 3 | Sacramento Sucker | | 3 | 335 | 430 | 1 | 0.16 | 0.16 | 0.154 |
| UCDavis | 1998 | 4 | Putah Creek downstream of Winters. | 4 | Green Sunfish | | 3 | 108 | 25 | 1 | 0.15 | 0.15 | 0.170 |
| UCDavis | 1998 | 4 | Putah Creek downstream of Winters. | 4 | Green Sunfish | | 3 | 108 | 23 | 1 | 0.19 | 0.19 | |
| UCDavis | 1998 | 4 | Putah Creek downstream of Winters. | 4 | Largemouth Bass | | 4 | 194 | 110 | 1 | 0.15 | 0.15 | 0.150 |
| UCDavis | 1998 | 4 | Putah Creek downstream of Winters. | 4 | Tule Perch | | 3 | 90 | 16 | 1 | 0.11 | 0.11 | 0.130 |
| UCDavis | 1998 | 4 | Putah Creek downstream of Winters. | 4 | Tule Perch | | 3 | 129 | 42 | 1 | 0.15 | 0.15 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Pike Minnow | | 4 | 232 | 107 | 1 | 0.17 | 0.17 | 0.300 |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Pike Minnow | | 4 | 257 | 135 | 1 | 0.26 | 0.26 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Pike Minnow | | 4 | 270 | 150 | 1 | 0.29 | 0.29 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Pike Minnow | | 4 | 453 | 990 | 1 | 0.48 | 0.48 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Sucker | | 3 | 217 | 115 | 1 | 0.1 | 0.1 | 0.125 |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Sucker | | 3 | 379 | 860 | 1 | 0.11 | 0.11 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Sucker | | 3 | 409 | 860 | 1 | 0.11 | 0.11 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Sucker | | 3 | 371 | 550 | 1 | 0.12 | 0.12 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Sucker | | 3 | 405 | 810 | 1 | 0.13 | 0.13 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Sacramento Sucker | | 3 | 388 | 800 | 1 | 0.18 | 0.18 | |
| UCDavis | 1998 | 5 | Putah Creek at Russell Ranch | 5 | Smallmouth Bass | | 4 | 143 | 40 | 1 | 0.25 | 0.25 | 0.250 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Black Crappie | | 4 | 182 | 103 | 1 | 0.33 | 0.33 | 0.330 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Bluegill | | 3 | 147 | 85 | 1 | 0.14 | 0.14 | 0.213 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Bluegill | | 3 | 153 | 112 | 1 | 0.18 | 0.18 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Bluegill | | 3 | 135 | 90 | 1 | 0.19 | 0.19 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Bluegill | | 3 | 135 | 75 | 1 | 0.2 | 0.2 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Bluegill | | 3 | 140 | 65 | 1 | 0.22 | 0.22 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Bluegill | | 3 | 148 | 85 | 1 | 0.24 | 0.24 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Bluegill | | 3 | 177 | 112 | 1 | 0.32 | 0.32 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Carp | | 3 | 495 | 1520 | 1 | 0.22 | 0.22 | 0.220 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Channel Catfish | | 4 | 510 | 1880 | 1 | 0.07 | 0.07 | 0.169 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Channel Catfish | | 4 | 378 | 750 | 1 | 0.11 | 0.11 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Channel Catfish | | 4 | 470 | 1570 | 1 | 0.12 | 0.12 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Channel Catfish | | 4 | 258 | 205 | 1 | 0.13 | 0.13 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Channel Catfish | | 4 | 413 | 1280 | 1 | 0.17 | 0.17 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Channel Catfish | | 4 | 500 | 1970 | 1 | 0.18 | 0.18 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Channel Catfish | | 4 | 437 | 1110 | 1 | 0.23 | 0.23 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Channel Catfish | | 4 | 395 | 710 | 1 | 0.34 | 0.34 | |
| ATSDR1 | 1995 | 4 | Approximately 3.3 miles upstream of LEHR | 6 | Composite 1 (Site 4) | Bluegill (70), Green Sunfish (13), Largemouth Bass (3), Crayfish (6), White Catfish (1) | 3-4 | | 3035 | 103 | 0.13 | 13.39 | 0.130 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Largemouth Bass | | 4 | 160 | 52 | 1 | 0.34 | 0.34 | 0.340 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Redear Sunfish | | 3 | 192 | 153 | 1 | 0.15 | 0.15 | 0.150 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Sacramento Blackfish | | 3 | 335 | 580 | 1 | 0.08 | 0.08 | 0.086 |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Sacramento Blackfish | | 3 | 335 | 630 | 1 | 0.09 | 0.09 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Sacramento Blackfish | | 3 | 366 | 760 | 1 | 0.09 | 0.09 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Sacramento Blackfish | | 3 | 379 | 820 | 1 | 0.09 | 0.09 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Sacramento Sucker | | 3 | 397 | 1000 | 1 | 0.1 | 0.1 | |
| UCDavis | 1998 | 6 | Putah Creek 2 miles upstream of UCDavis (app) 6 | 6 | Sacramento Sucker | | 3 | 377 | 470 | 1 | 0.13 | 0.13 | 0.130 |

| Source | Date | Study Location | Location Description | Downstream Order | Species | Composite Description | TL | Size or Length (mm) | Weight (g) | # of Fish | Hg Conc (ppm, wet wt) | # of Fish • Conc | Species Mean at Each Location |
|---------|------|----------------|--|------------------|------------------------|--|-----|---------------------|------------|-----------|-----------------------|------------------|-------------------------------|
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | Sacramento Blackfish | | 3 | 354 | 895 | 1 | 0.07 | 0.07 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | Sacramento Blackfish | | 3 | 377 | 780 | 1 | 0.07 | 0.07 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | Sacramento Blackfish | | 3 | 419 | 1140 | 1 | 0.08 | 0.08 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | Sacramento Blackfish | | 3 | 355 | 555 | 1 | 0.09 | 0.09 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | Sacramento Blackfish | | 3 | 385 | 820 | 1 | 0.11 | 0.11 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | White Catfish | | 4 | 380 | 745 | 1 | 0.1 | 0.1 | 0.134 |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | White Catfish | | 4 | 413 | 1310 | 1 | 0.11 | 0.11 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | White Catfish | | 4 | 348 | 855 | 1 | 0.12 | 0.12 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | White Catfish | | 4 | 332 | 595 | 1 | 0.13 | 0.13 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | White Catfish | | 4 | 359 | 720 | 1 | 0.13 | 0.13 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | White Catfish | | 4 | 431 | 1390 | 1 | 0.18 | 0.18 | |
| UCDavis | 1998 | 9 | Putah Creek 0.7 miles downstream of UCDavis (10) | | White Catfish | | 4 | 340 | 610 | 1 | 0.19 | 0.19 | |
| ATSDR1 | 1998 | 3 | Approximately 2.4 miles downstream of LEHR | 11 | Composite 1 (Site 3) | Black Crappie (2), Largemouth Bass (1) | 3-4 | | 1598 | 3 | 0.24 | 0.72 | 0.155 |
| ATSDR1 | 1999 | 3 | Approximately 2.4 miles downstream of LEHR | 11 | Composite 2 (Site 3) | Crayfish (9), Carp (1) | 3-4 | | 1895 | 10 | 0.13 | 1.3 | |
| ATSDR1 | 1999 | 3 | Approximately 2.4 miles downstream of LEHR | 11 | White Catfish | White Catfish (1) | 4 | | 2824 | 1 | 0.48 | 0.48 | 0.480 |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream | 12 | Black Bullhead | | 3 | N/A | | 1 | 0.0984 | 0.0984 | 0.099 |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream | 12 | Bluegill | | 3 | Large | | 1 | 0.127 | 0.127 | 0.133 |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream | 12 | Bluegill | | 3 | Small | | 3 | 0.135 | 0.405 | 0.080 |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream | 12 | Carp | | 3 | Large | | 1 | 0.0802 | 0.0802 | 0.147 |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream | 12 | Largemouth Bass | | 4 | Small | | 2 | 0.123 | 0.246 | |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream | 12 | Largemouth Bass | | 4 | Medium | | 2 | 0.171 | 0.342 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Carp | | 3 | 392 | 805 | 1 | 0.14 | 0.14 | 0.163 |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Carp | | 3 | 411 | 1040 | 1 | 0.15 | 0.15 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Carp | | 3 | 402 | 1210 | 1 | 0.15 | 0.15 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Carp | | 3 | 427 | 1440 | 1 | 0.16 | 0.16 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Carp | | 3 | 432 | 1280 | 1 | 0.2 | 0.2 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Carp | | 3 | 333 | 535 | 1 | 0.23 | 0.23 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Carp | | 3 | 457 | 1750 | 1 | 0.25 | 0.25 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Channel Catfish | | 4 | 394 | 740 | 1 | 0.07 | 0.07 | 0.075 |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Channel Catfish | | 4 | 349 | 480 | 1 | 0.08 | 0.08 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Largemouth Bass | | 4 | 385 | 970 | 1 | 0.63 | 0.63 | 0.680 |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Largemouth Bass | | 4 | 387 | 930 | 1 | 0.73 | 0.73 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Largemouth Bass | | 4 | 338 | 505 | 1 | 0.08 | 0.08 | 0.110 |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Sacramento Blackfish | | 3 | 276 | 285 | 1 | 0.07 | 0.07 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Sacramento Blackfish | | 3 | 303 | 385 | 1 | 0.07 | 0.07 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Sacramento Blackfish | | 3 | 384 | 315 | 1 | 0.08 | 0.08 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Sacramento Blackfish | | 3 | 303 | 355 | 1 | 0.12 | 0.12 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Sacramento Blackfish | | 3 | 398 | 840 | 1 | 0.14 | 0.14 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Sacramento Blackfish | | 3 | 387 | 600 | 1 | 0.23 | 0.23 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Sacramento Pike Minnow | | 4 | 252 | 165 | 1 | 0.72 | 0.72 | 0.725 |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | Sacramento Pike Minnow | | 4 | 318 | 250 | 1 | 0.73 | 0.73 | |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | White Catfish | | 4 | 320 | 545 | 1 | 0.18 | 0.18 | 0.180 |
| UCDavis | 1998 | 11 | Putah Creek at Road 106A (approximately 7 mil) | 13 | White Catfish | | 4 | 359 | 735 | 1 | 0.63 | 0.63 | 0.630 |
| SRWP | 1999 | | Putah Creek | 147 | Bluegill | | 3 | 112 | 0.087 | 5 | 0.087 | 0.485 | 0.110 |
| SRWP | 1999 | | Putah Creek | 147 | Bluegill | | 3 | 135 | 0.123 | 5 | 0.123 | 0.615 | |
| SRWP | 1999 | | Putah Creek | 147 | Sacramento sucker | | 3 | 363 | 0.185 | 4 | 0.185 | 0.74 | 0.185 |
| SRWP | 1999 | | Putah Creek | 147 | Largemouth bass | | 4 | 345 | | 1 | 0.231 | 0.231 | 0.478 |
| SRWP | 1999 | | Putah Creek | 147 | Largemouth bass | | 4 | 354 | | 1 | 0.398 | 0.398 | |
| SRWP | 1999 | | Putah Creek | 147 | Largemouth bass | | 4 | 410 | | 1 | 0.54 | 0.54 | |
| SRWP | 1999 | | Putah Creek | 147 | Largemouth bass | | 4 | 425 | | 1 | 0.592 | 0.592 | |
| SRWP | 1999 | | Putah Creek | 147 | Largemouth bass | | 4 | 402 | | 1 | 0.83 | 0.83 | |
| SRWP | 1999 | | Putah Creek | 147 | White Catfish | | 4 | 470 | | 1 | 0.148 | 0.148 | 0.146 |

| Average | # of Fish |
|-----------|-----------|
| TL2: 0.03 | 1 |
| TL3: 0.12 | 204 |
| TL4: 0.28 | 67 |

More Comments:

| Source | Date | Location | Location Description | Downstream Order | Species | Composite Description | TL (mm) | Size or Length (mm) | Weight (g) | # of Fish | Hg Conc (ppm, wet wt) | # of Fish Conc | Species Mean |
|----------------|------|----------|---|------------------|----------------------|-----------------------|---------|---------------------|------------|-----------|-----------------------|----------------|--------------|
| Tropic Level 2 | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Chum (Pulchra) | | 2 | | | 1 | 0.03 | 0.03 | 0.007 |
| Tropic Level 3 | 1998 | 3 | Above Mace Boulevard, about 3 miles downstream of Old Davis Road and 2.5 miles downstream of storm drain on | 12 | Black Bullhead | | 3 | N/A | | 1 | 0.0994 | 0.0994 | 0.099 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Bluegill | | 3 | 147 | 85 | 1 | 0.14 | 0.14 | 0.170 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Bluegill | | 3 | 153 | 112 | 1 | 0.18 | 0.18 | 0.170 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Bluegill | | 3 | 135 | 50 | 1 | 0.19 | 0.19 | 0.170 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Bluegill | | 3 | 135 | 75 | 1 | 0.2 | 0.2 | 0.170 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Bluegill | | 3 | 140 | 55 | 1 | 0.22 | 0.22 | 0.170 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Bluegill | | 3 | 148 | 65 | 1 | 0.24 | 0.24 | 0.170 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Bluegill | | 3 | 177 | 112 | 1 | 0.32 | 0.32 | 0.170 |
| ATSDR2 | 1997 | 4 | Upstream of LEHR site, west of Davis at Pedrick Road crossing (downstream of Site 4 in ATSDR1). | 7 | Bluegill | | 3 | Large | | 2 | 0.0853 | 0.0853 | 0.0853 |
| ATSDR2 | 1997 | 4 | Upstream of LEHR site, west of Davis at Pedrick Road crossing (downstream of Site 4 in ATSDR1). | 7 | Bluegill | | 3 | Small | | 2 | 0.108 | 0.108 | 0.0853 |
| ATSDR2 | 1997 | 4 | Upstream of LEHR site, west of Davis at Pedrick Road crossing (downstream of Site 4 in ATSDR1). | 7 | Bluegill | | 3 | Medium | | 2 | 0.115 | 0.115 | 0.0853 |
| ATSDR2 | 1997 | 4 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Large | | 2 | 0.0237 | 0.0237 | 0.0474 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Small | | 27 | 0.106 | 0.106 | 0.0474 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Medium | | 29 | 0.11 | 0.11 | 0.0474 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Small | | 13 | 0.0633 | 0.0633 | 0.0474 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Medium | | 6 | 0.0762 | 0.0762 | 0.0474 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Large | | 4 | 0.0853 | 0.0853 | 0.0474 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Small | | 6 | 0.0749 | 0.0749 | 0.0474 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Medium | | 4 | 0.107 | 0.107 | 0.0474 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Bluegill | | 3 | Small | | 4 | 0.12 | 0.12 | 0.0474 |
| UCDavis | 1998 | 9 | One mile downstream of Old Davis Road and 0.5 miles downstream of storm drain on eastern edge of LEHR site | 10 | Bluegill | | 3 | 104 | 22 | 1 | 0.12 | 0.12 | 0.0474 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Bluegill | | 3 | 117 | 30 | 1 | 0.16 | 0.16 | 0.0474 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Bluegill | | 3 | 119 | 35 | 1 | 0.16 | 0.16 | 0.0474 |
| ATSDR2 | 1997 | 2 | One mile downstream of Old Davis Road and 0.5 miles downstream of storm drain on eastern edge of LEHR site | 10 | Bluegill | | 3 | Large | | 2 | 0.195 | 0.195 | 0.0474 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Bluegill | | 3 | 109 | 29 | 1 | 0.25 | 0.25 | 0.0474 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Bluegill | | 3 | 142 | 46 | 1 | 0.33 | 0.33 | 0.0474 |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream of Old Davis Road and 2.5 miles downstream of storm drain on | 12 | Bluegill | | 3 | Large | | 1 | 0.127 | 0.127 | 0.0474 |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream of Old Davis Road and 2.5 miles downstream of storm drain on | 12 | Bluegill | | 3 | Small | | 3 | 0.135 | 0.135 | 0.0474 |
| SRNP | 1999 | 147 | Pulch Creek | 147 | Bluegill | | 3 | 135 | | 5 | 0.123 | 0.123 | 0.0474 |
| SRNP | 1999 | 147 | Pulch Creek | 147 | Bluegill | | 3 | 112 | | 5 | 0.097 | 0.097 | 0.0474 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Carp | | 3 | 435 | 1520 | 1 | 0.22 | 0.22 | 0.181 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Carp | | 3 | Large | | 1 | 0.109 | 0.109 | 0.181 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Carp | | 3 | Small | | 1 | 0.0565 | 0.0565 | 0.181 |
| ATSDR2 | 1997 | 5 | Between sites #1 and #4, at the APO picnic grounds (where Arden Way meets Pulch Creek). | 8 | Carp | | 3 | Large | | 1 | 0.111 | 0.111 | 0.181 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Carp | | 3 | 395 | 1060 | 1 | 0.12 | 0.12 | 0.181 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Carp | | 3 | 525 | 2000 | 1 | 0.13 | 0.13 | 0.181 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Carp | | 3 | 460 | 2025 | 1 | 0.15 | 0.15 | 0.181 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Carp | | 3 | 311 | 555 | 1 | 0.16 | 0.16 | 0.181 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Carp | | 3 | 541 | 3300 | 1 | 0.21 | 0.21 | 0.181 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Carp | | 3 | 620 | 4800 | 1 | 0.21 | 0.21 | 0.181 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Carp | | 3 | 429 | 1450 | 1 | 0.22 | 0.22 | 0.181 |
| ATSDR2 | 1997 | 3 | Above Mace Boulevard, about 3 miles downstream of Old Davis Road and 2.5 miles downstream of storm drain on | 12 | Carp | | 3 | Large | | 1 | 0.0802 | 0.0802 | 0.181 |
| UCDavis | 1998 | 11 | Pulch Creek at Road 106A (approximately 7 miles downstream of LEHR). | 13 | Carp | | 3 | 382 | 805 | 1 | 0.14 | 0.14 | 0.181 |
| UCDavis | 1998 | 11 | Pulch Creek at Road 106A (approximately 7 miles downstream of LEHR). | 13 | Carp | | 3 | 411 | 1040 | 1 | 0.15 | 0.15 | 0.181 |
| UCDavis | 1998 | 11 | Pulch Creek at Road 106A (approximately 7 miles downstream of LEHR). | 13 | Carp | | 3 | 402 | 1210 | 1 | 0.15 | 0.15 | 0.181 |
| UCDavis | 1998 | 11 | Pulch Creek at Road 106A (approximately 7 miles downstream of LEHR). | 13 | Carp | | 3 | 427 | 1440 | 1 | 0.16 | 0.16 | 0.181 |
| UCDavis | 1998 | 11 | Pulch Creek at Road 106A (approximately 7 miles downstream of LEHR). | 13 | Carp | | 3 | 432 | 1280 | 1 | 0.2 | 0.2 | 0.181 |
| UCDavis | 1998 | 11 | Pulch Creek at Road 106A (approximately 7 miles downstream of LEHR). | 13 | Carp | | 3 | 333 | 535 | 1 | 0.23 | 0.23 | 0.181 |
| UCDavis | 1998 | 11 | Pulch Creek at Road 106A (approximately 7 miles downstream of LEHR). | 13 | Carp | | 3 | 457 | 1750 | 1 | 0.25 | 0.25 | 0.181 |
| UCDavis | 1998 | 4 | Pulch Creek downstream of Winery. | 4 | Green Sunfish | | 3 | 108 | 25 | 1 | 0.15 | 0.15 | 0.170 |
| UCDavis | 1998 | 4 | Pulch Creek downstream of Winery. | 4 | Green Sunfish | | 3 | 108 | 23 | 1 | 0.19 | 0.19 | 0.170 |
| UCDavis | 1998 | 2 | In Lake Solano. | 2 | Hitch | | 3 | 194 | 95 | 1 | 0.12 | 0.12 | 0.095 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Hitch | | 3 | 278 | 315 | 1 | 0.07 | 0.07 | 0.095 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Hitch | | 3 | 294 | 355 | 1 | 0.08 | 0.08 | 0.095 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Hitch | | 3 | 288 | 345 | 1 | 0.09 | 0.09 | 0.095 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Hitch | | 3 | 274 | 305 | 1 | 0.1 | 0.1 | 0.095 |
| UCDavis | 1998 | 9 | Pulch Creek 0.7 miles downstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | Hitch | | 3 | 306 | 360 | 1 | 0.11 | 0.11 | 0.095 |
| UCDavis | 1998 | 1 | Pulch Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 337 | 425 | 1 | 0.05 | 0.05 | 0.095 |
| UCDavis | 1998 | 1 | Pulch Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 245 | 205 | 1 | 0.06 | 0.06 | 0.095 |
| UCDavis | 1998 | 1 | Pulch Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 183 | 82 | 1 | 0.07 | 0.07 | 0.095 |
| UCDavis | 1998 | 1 | Pulch Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 225 | 159 | 1 | 0.07 | 0.07 | 0.095 |
| UCDavis | 1998 | 1 | Pulch Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 259 | 215 | 1 | 0.07 | 0.07 | 0.095 |
| UCDavis | 1998 | 1 | Pulch Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 348 | 505 | 1 | 0.08 | 0.08 | 0.095 |
| UCDavis | 1998 | 1 | Pulch Creek downstream of Lake Berryessa. | 1 | Rainbow Trout | | 3 | 383 | 580 | 1 | 0.15 | 0.15 | 0.095 |
| UCDavis | 1998 | 3 | Pulch Creek downstream of Lake Solano. | 3 | Rainbow Trout | | 3 | 193 | 105 | 1 | 0.08 | 0.08 | 0.095 |
| UCDavis | 1998 | 3 | Pulch Creek downstream of Lake Solano. | 3 | Rainbow Trout | | 3 | 185 | 75 | 1 | 0.09 | 0.09 | 0.095 |
| UCDavis | 1998 | 3 | Pulch Creek downstream of Lake Solano. | 3 | Rainbow Trout | | 3 | 189 | 72 | 1 | 0.1 | 0.1 | 0.095 |
| UCDavis | 1998 | 3 | Pulch Creek downstream of Lake Solano. | 3 | Rainbow Trout | | 3 | 166 | 60 | 1 | 0.12 | 0.12 | 0.095 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Rainbow Sunfish | | 3 | 192 | 153 | 1 | 0.15 | 0.15 | 0.150 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Sacramento Blackfish | | 3 | 335 | 580 | 1 | 0.06 | 0.06 | 0.068 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Sacramento Blackfish | | 3 | 335 | 630 | 1 | 0.08 | 0.08 | 0.068 |
| UCDavis | 1998 | 6 | Pulch Creek 2 miles upstream of UC Davis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Sacramento Blackfish | | 3 | 355 | 700 | 1 | 0.09 | 0.09 | 0.068 |

| Source | Date | Location | Location Description | Downstream Order | Species | Composita Description | TL (mm) | Size or Length | Weight (g) | # of Fish | Hg Conc (ppm, wet wt) | # of Fish * Conc | Species Mean |
|---------|------|----------|---|------------------|------------------------|---|---------|----------------|------------|-----------|-----------------------|------------------|--------------|
| SRWP | 1999 | | Puiah Creek | 147 | Largemouth bass | | 4 | 345 | | 1 | 0.231 | 0.231 | |
| UCDavis | 1998 | 5 | Puiah Creek at Russell Ranch | 5 | Sacramento Pike Minnow | | 4 | 232 | 107 | 1 | 0.17 | 0.17 | 0.442 |
| UCDavis | 1998 | 5 | Puiah Creek at Russell Ranch | 5 | Sacramento Pike Minnow | | 4 | 257 | 135 | 1 | 0.29 | 0.29 | 0.25 |
| UCDavis | 1998 | 5 | Puiah Creek at Russell Ranch | 5 | Sacramento Pike Minnow | | 4 | 270 | 150 | 1 | 0.29 | 0.29 | 0.29 |
| UCDavis | 1998 | 5 | Puiah Creek at Russell Ranch | 5 | Sacramento Pike Minnow | | 4 | 453 | 950 | 1 | 0.48 | 0.48 | 0.48 |
| UCDavis | 1998 | 11 | Puiah Creek at Road 106A (approximately 7 miles downstream of LEHR) | 13 | Sacramento Pike Minnow | | 4 | 252 | 185 | 1 | 0.72 | 0.72 | 0.72 |
| UCDavis | 1998 | 11 | Puiah Creek at Road 106A (approximately 7 miles downstream of LEHR) | 13 | Sacramento Pike Minnow | | 4 | 318 | 250 | 1 | 0.73 | 0.73 | 0.73 |
| UCDavis | 1998 | 5 | Puiah Creek at Russell Ranch | 5 | Smallmouth Bass | | 4 | 143 | 40 | 1 | 0.25 | 0.25 | 0.200 |
| UCDavis | 1998 | 8 | Puiah Creek 2 miles upstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | Smallmouth Bass | | 4 | 208 | 100 | 1 | 0.35 | 0.35 | 0.35 |
| UCDavis | 1998 | 9 | Puiah Creek 0.7 miles downstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | White Catfish | | 4 | 360 | 745 | 1 | 0.1 | 0.1 | 0.175 |
| UCDavis | 1998 | 9 | Puiah Creek 0.7 miles downstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | White Catfish | | 4 | 413 | 1310 | 1 | 0.11 | 0.11 | 0.11 |
| UCDavis | 1998 | 9 | Puiah Creek 0.7 miles downstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | White Catfish | | 4 | 348 | 655 | 1 | 0.12 | 0.12 | 0.12 |
| UCDavis | 1998 | 9 | Puiah Creek 0.7 miles downstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | White Catfish | | 4 | 332 | 595 | 1 | 0.13 | 0.13 | 0.13 |
| UCDavis | 1998 | 9 | Puiah Creek 0.7 miles downstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | White Catfish | | 4 | 359 | 720 | 1 | 0.13 | 0.13 | 0.13 |
| UCDavis | 1998 | 9 | Puiah Creek 0.7 miles downstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | White Catfish | | 4 | 431 | 1390 | 1 | 0.16 | 0.16 | 0.16 |
| UCDavis | 1998 | 9 | Puiah Creek 0.7 miles downstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 2) | 10 | White Catfish | | 4 | 340 | 610 | 1 | 0.19 | 0.19 | 0.19 |
| ATSDR1 | 1995 | 3 | Approximately 2.4 miles downstream of LEHR | 11 | White Catfish | White Catfish (1) | 4 | | 2624 | 1 | 0.48 | 0.48 | 0.48 |
| UCDavis | 1998 | 11 | Puiah Creek at Road 106A (approximately 7 miles downstream of LEHR) | 13 | White Catfish | | 4 | 320 | 545 | 1 | 0.18 | 0.18 | 0.18 |
| SRWP | 1999 | | Puiah Creek | 147 | White Catfish | | 4 | 470 | | 1 | 0.148 | 0.148 | |
| UCDavis | 1998 | 6 | Puiah Creek 2 miles upstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | White Crappie | | 4 | 167 | 50 | 1 | 0.15 | 0.15 | 0.203 |
| UCDavis | 1998 | 6 | Puiah Creek 2 miles upstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | White Crappie | | 4 | 190 | 83 | 1 | 0.16 | 0.16 | 0.16 |
| UCDavis | 1998 | 6 | Puiah Creek 2 miles upstream of UCDavis (approximately same location as ATSDR1 and ATSDR2 Site 4) | 6 | White Crappie | | 4 | 165 | 48 | 1 | 0.19 | 0.19 | 0.19 |
| UCDavis | 1998 | 11 | Puiah Creek at Road 106A (approximately 7 miles downstream of LEHR) | 13 | White Crappie | | 4 | 359 | 735 | 1 | 0.63 | 0.63 | 0.63 |
| ATSDR1 | 1995 | 2 | Approximately 1.2 miles downstream of LEHR | 10 | Composita 1 (Site 2) | Carp (1), Black Bullhead (1) | 3 | | 1776 | 2 | 0.16 | 0.32 | 0.160 |
| ATSDR1 | 1995 | 1 | Adjacent to LEHR | 9 | Composita 1 (Site 1) | Black Crappie (2), Bluegill (1), Largemouth Bass (2) | 3-4 | | 1747 | 5 | 0.69 | 3.45 | 0.600 |
| ATSDR1 | 1995 | 3 | Approximately 2.4 miles downstream of LEHR | 11 | Composita 1 (Site 3) | Black Crappie (2), Largemouth Bass (1) | 3-4 | | 1598 | 3 | 0.24 | 0.72 | 0.240 |
| ATSDR1 | 1995 | 4 | Approximately 3.3 miles upstream of LEHR | 6 | Composita 1 (Site 4) | Bluegill (78), Green Sunfish (13), Largemouth Bass (3), Crayfish (9), White Catfish (1) | 3-4 | | 3035 | 103 | 0.13 | 13.39 | 0.130 |
| ATSDR1 | 1995 | 1 | Adjacent to LEHR | 9 | Composita 2 (Site 1) | Crayfish (10), Black Bullhead (4), White Catfish (2) | 3-4 | | 3020 | 16 | 0.15 | 2.4 | 0.150 |
| ATSDR1 | 1995 | 3 | Approximately 2.4 miles downstream of LEHR | 11 | Composita 2 (Site 3) | Crayfish (9), Carp (1) | 3-4 | | 1995 | 10 | 0.13 | 1.3 | 0.130 |