Appendix G

River Toxicity Tests

by Southern California Coastal Waters Research Project

LOS ANGELES COUNTY RIVER TOXICITY REPORT: JANUARY THROUGH MARCH, 1999 WET WEATHER SAMPLES

Prepared for
Los Angeles County Department of Public Works

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TOXICITY MEASUREMENT OF JANUARY THROUGH MARCH 1999 WET WEATHER RIVER SAMPLES

INTRODUCTION

This report presents results for the toxicity analysis of samples of wet weather flow from the Los Angeles and San Gabriel Rivers. The tests were conducted as partial fulfillment of the monitoring requirements mandated by NPDES Permit No. CAS614001 from the California Regional Water Quality Control Board (Los Angeles Region).

METHODS

Sampling was conducted by LACDPW personnel during wet weather flow conditions at the Los Angeles and San Gabriel Rivers. Samples were taken during two storms for the Los Angeles River and one storm for the San Gabriel. The wet weather sample was collected by autosampler from the San Gabriel River on January 26, 1999. A single grab sample was taken from the Los Angeles River during storms on March 15 and March 20, 1999. Sampling locations were LACDPW mass emission stations S-10 (Los Angeles River) and S-14 (San Gabriel River). Samples were stored under refrigeration until tested on January 27, March 16 and March 22, respectively.

Toxicity was measured using the purple sea urchin fertilization test as described by Chapman *et al*., 1995. Sea urchin gametes were obtained from specimens collected from a relatively uncontaminated area in northern Santa Monica Bay. In the test, sea urchin sperm are exposed to various concentrations of the test sample for 20 minutes at a temperature of approximately 15 °C. Sea urchin eggs are then added to each sample and given 20 minutes for fertilization to occur. Preservative is then added to the samples, which are later examined with a microscope to determine the percentage of fertilized eggs.

Since the toxicity test uses a marine organism, the salinity of the river samples was adjusted to a typical seawater value by addition of hypersaline brine. Addition of the brine diluted the samples, restricting the highest concentration of sample tested to 50%. Additional test concentrations (25, 12, 6, 3, and 1.5%) were prepared by adding laboratory seawater (filtered natural seawater collected from offshore Redondo Beach) to the samples. A brine control was included in the experiment to check for toxicity introduced by the salinity adjustment procedure. The brine control consisted of deionized water, laboratory seawater, and brine at the same concentration found in the 50% and 25% river samples.

A reference toxicant test was conducted concurrently with the river tests in order to document variability in test sensitivity. This test consisted of five concentrations of dissolved copper, ranging from 10 µg/L to 65 µg/L.

Water quality measurements (pH, dissolved oxygen, conductivity, and total ammonia) were made on the test samples at the beginning of the toxicity test. For the river samples, water quality was measured on the 50%, 12% and 3% concentrations. All measurements were made using electrodes. Sample salinity was calculated from the conductivity and temperature data. Un-ionized ammonia (NH_3) concentration was calculated from the total ammonia, pH, salinity, and temperature data.

For each experiment, we attempted to calculate an EC_{50} (concentration producing a 50% reduction in fertilization) and NOEC (highest test concentration that does not produce a statistically significant reduction in fertilization). The EC_{50} was calculated by probit analysis of the raw percent fertilized data. If there was less than a 50% reduction in fertilization success, then an EC_{50} could not be calculated. The NOEC was calculated by first arcsine transforming the percent fertilized data, then testing for homogenity of variance and normal distribution of the data. Data that passed these tests were then subjected to a one way analysis of variance (ANOVA). If a significant difference between treatments was detected ($p \leq 0.05$), a Dunnett's multiple range test was performed to test for differences between the control value and each of the concentrations. Data that did not pass the test for homogenity of variance and/or normal distribution were subjected to a non-parametric Steel's Many-One Rank test. If there was not a significant reduction in fertilization relative to the control, then a NOEC could not be calculated.

RESULTS AND DISCUSSION

No toxicity was detected in the wet weather sample from San Gabriel River taken in January (Figure 1). Since there was no reduction in fertilization caused by this sample, neither a NOEC nor an EC_{50} could be calculated (Table 1). The lack of toxicity from this sample is consistent with the results of testing from another San Gabriel River sample taken earlier in the storm season (SCCWRP 1998).

Sea urchin fertilization was significantly reduced by exposure to samples from the Los Angeles River for both storms in (Figures 2 and 3). The greatest toxicity was present in the March 15 storm sample. The NOEC for this storm was 12.5%, which represents 8 chronic toxicity units (TU_c=100/NOEC). The March 20 sample had a NOEC of 25% (4 TU_c). The EC_{50} for the first storm was 24% sample. Since the sample from the second storm did not cause a 50% reduction in fertilization, an EC_{50} could not be calculated (Table 1).

All of the experiments met the test acceptability criteria. For the San Gabriel River sampling, the control seawater fertilization percentage averaged 91% and the 50% brine control averaged 98%, well above the minimum acceptable value of 70%. The Los Angeles River samples also had good control results with the seawater control averaging 89% and 100% respectively and the 50% brine control greater than 83% and 100%. Summaries of the fertilization counts for each experiment are shown in Tables 2-4.

The results of water quality measurements are shown in Tables 5-7. The pH, dissolved oxygen, and salinity of the samples were within acceptable ranges for all of the experiments. Total ammonia in the San Gabriel River (2.01 mg /L) wet weather sample was elevated relative to the control, but was well below the level (>20 mg /L) that would be expected to cause toxicity in the sea urchin fertilization test.

The copper reference toxicant tests conducted with each experiment also met performance standards. The EC_{50} values for these tests ranged from 27-48 µg/L, which are similar to the historical average for our laboratory (27.6 µg/L). The data for all three of the tests are within the range for an acceptable test (4.2 to 51.0 µg/L) (Figure 4). The relatively high EC_{50} for the March 22 experiment may indicate a somewhat less sensitive test than we would normally achieve.

LITERATURE CITED

Chapman, G.A., D.L. Denton, and J.M. Lazorchak. 1995. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to west coast marine and estuarine organisms. EPA/600/R-95/136, National Exposure Research Laboratory, U. S. Environmental Protection Agency, Cincinnati, OH. 661p.

SCCWRP. 1998. Los Angeles County river toxicity report: October dry weather and November wet weather samples. Submitted to Los Angeles County Department of Public Works. Southern California Coastal Water Research, Westminster, CA. 11p.

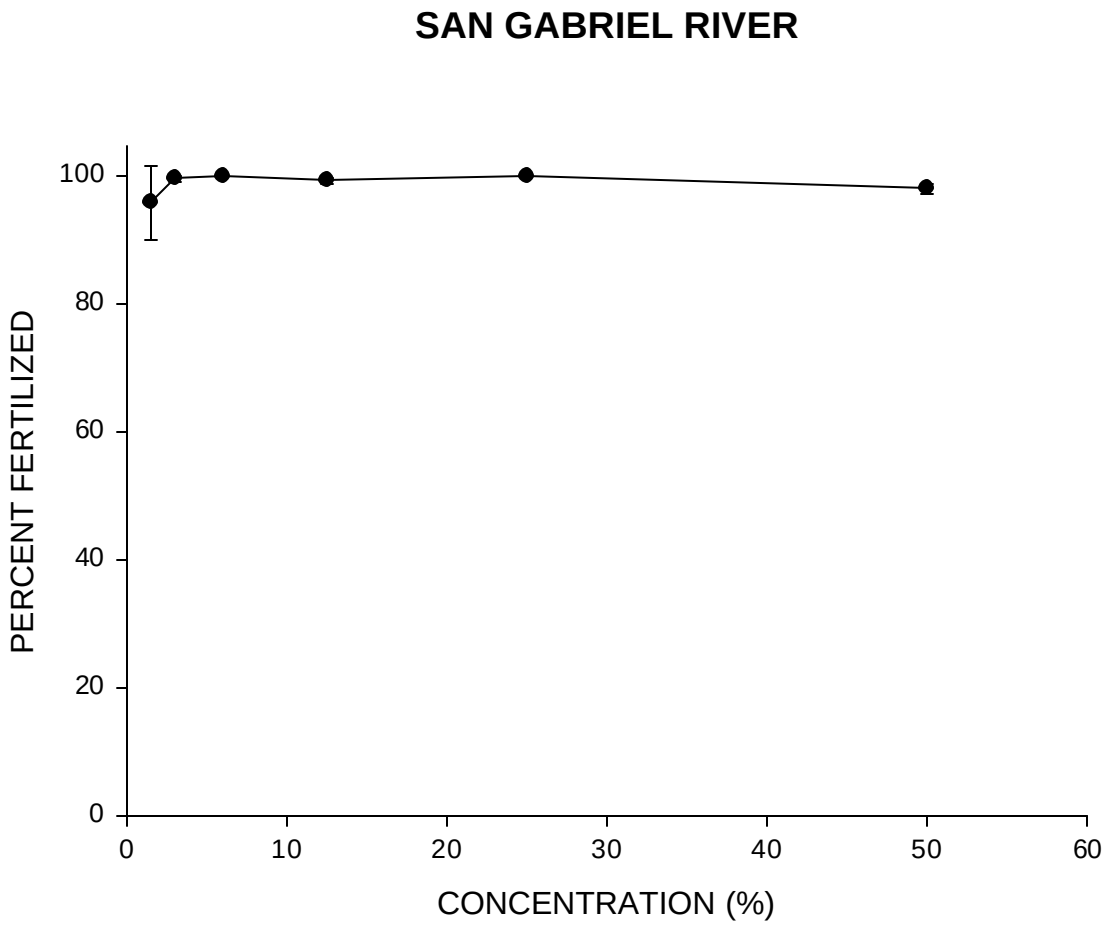

Figure 1. Dose-response plot of sea urchin fertilization test results for San Gabriel River wet weather flow composite collected January 26, 1999. Symbols represent the mean of 5 replicates and the standard deviation.

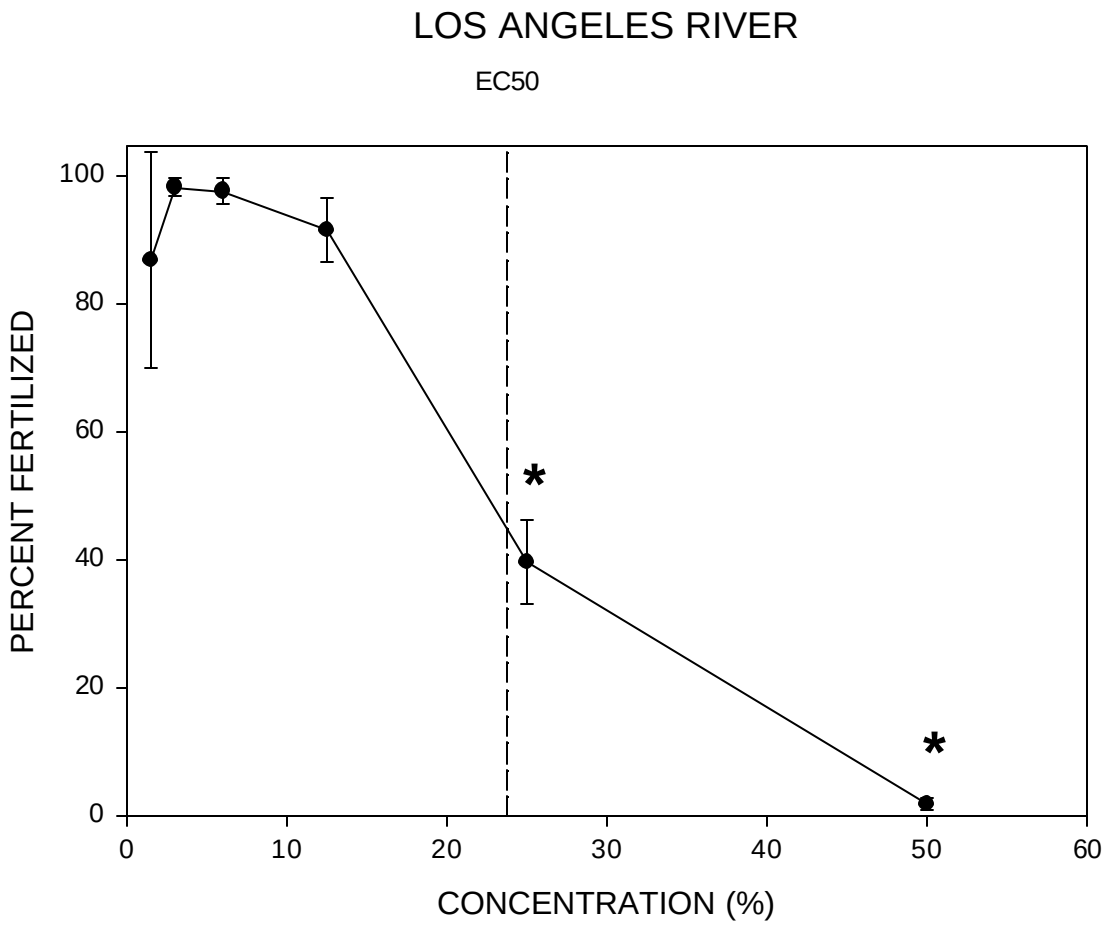

Figure 2. Dose-response plot of sea urchin fertilization test results for Los Angeles River wet weather flow grab collected March 15, 1999. Symbols represent the mean of 5 replicates and the standard deviation. Asterisks indicate concentrations that were significantly different from control ($p \leq 0.05$).

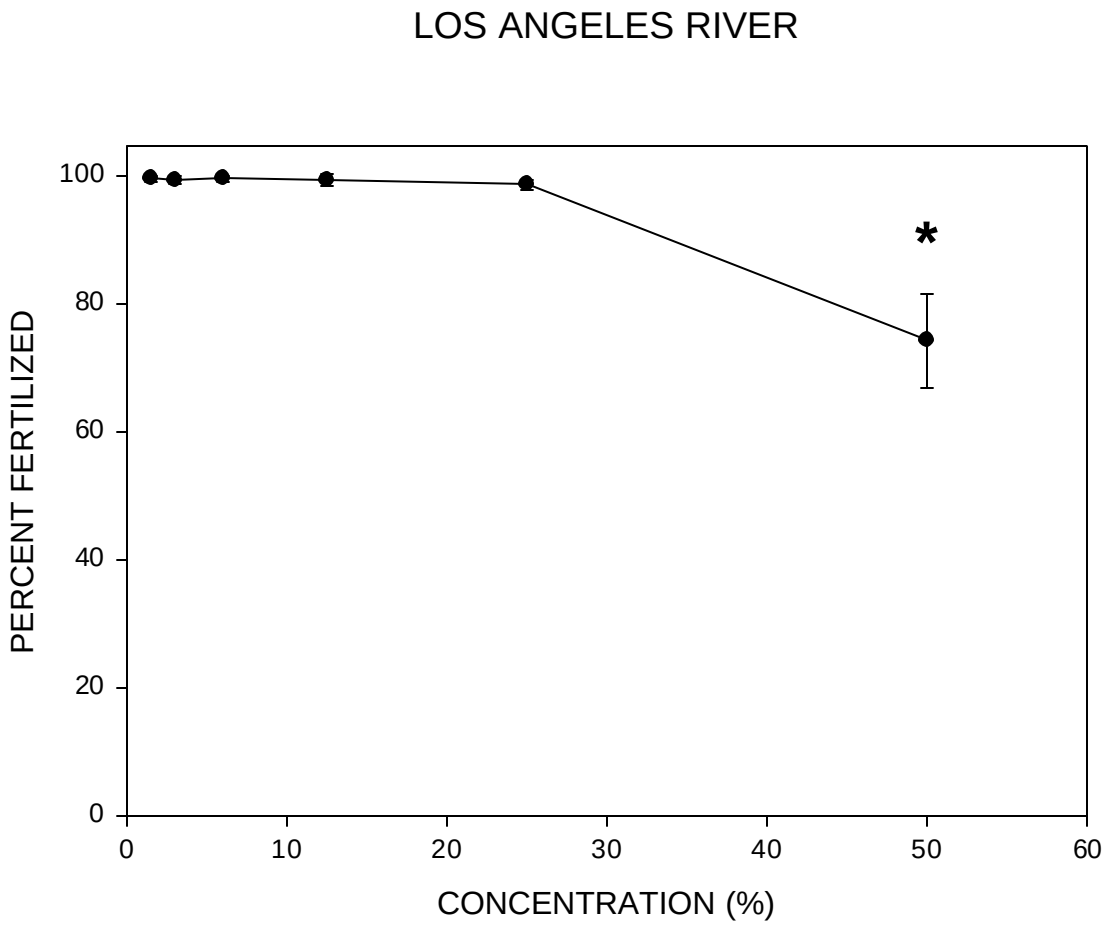

Figure 3. Dose-response plot of sea urchin fertilization test results for Los Angeles River wet weather flow grab collected March 20, 1999. Symbols represent the mean of 5 replicates and the standard deviation. Asterisk indicates concentration that was significantly different from control ($p \leq 0.05$).

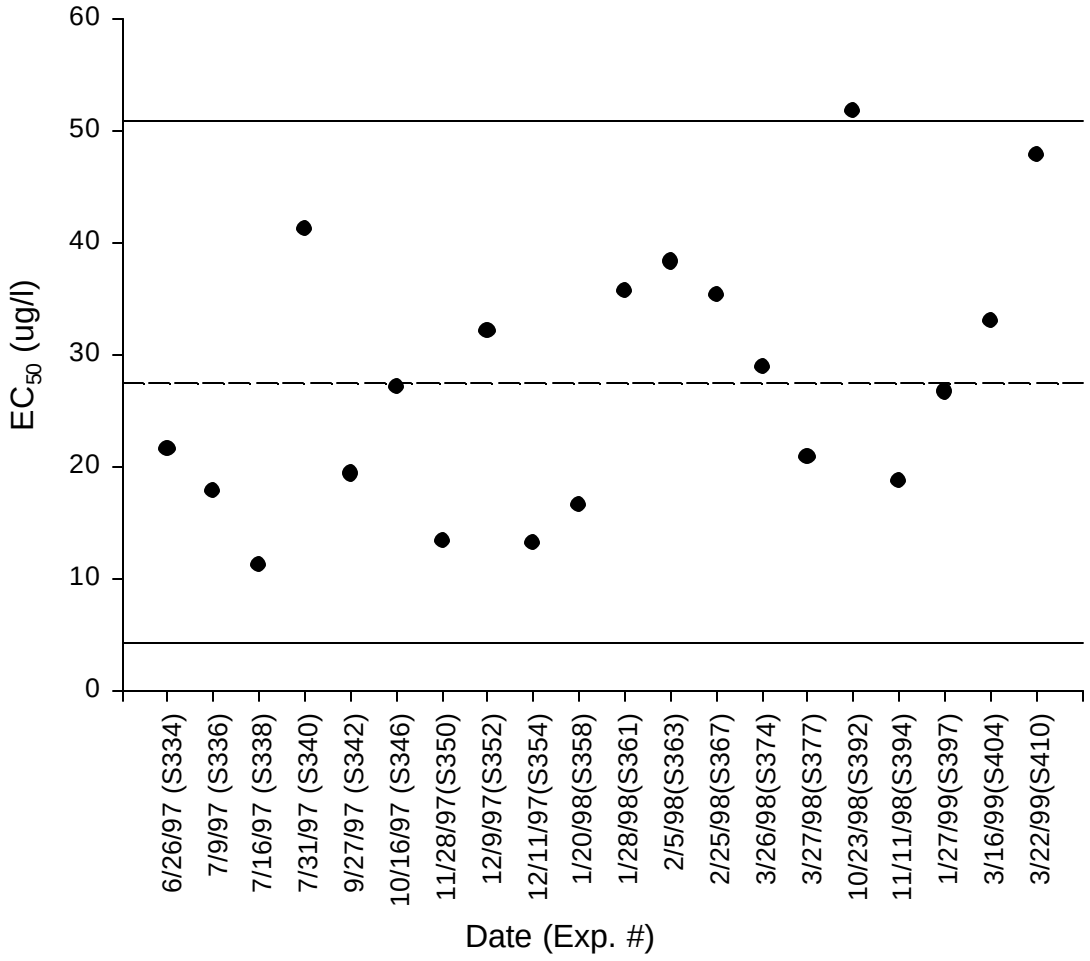

Figure 4. Control chart for purple sea urchin fertilization test of copper reference toxicant samples. Control lines represent two standard deviations of mean EC_{50} (concentration producing a 50% reduction in fertilization).

Table 1. Summary of sea urchin fertilization test results for San Gabriel River and Los Angeles River. Rainfall data is from Los Angeles Civic Center and is total for entire storm.

Location	Date	Rainfall (in)	EC50 (%)	NOEC (%)	Toxic units (TU_c)
San Gabriel River	1/26/99	1.15	>50	≥50	≤2
Los Angeles River	3/15/99	0.45	24	12.5	8
Los Angeles River	3/20/99	0.24	>50	25	4

Table 2. Sea urchin fertilization results for experiment No. S396. Sample collected on 1/26/99 and tested on 1/27/99.

			Percent Fertilized			
Log No.	Description	Concentration (%)		Mean	Std Dev	N
USSW01271	Seawater Control		100	91	14.2	5
USSW01271	Seawater Control		68			
USSW01271	Seawater Control		85			
USSW01271	Seawater Control		100			
USSW01271	Seawater Control		100			
USBK01271	Brine Control	50	100	98	2.7	5
USBK01271	Brine Control	50	99			
USBK01271	Brine Control	50	96			
USBK01271	Brine Control	50	100			
USBK01271	Brine Control	50	94			
USBK01271	Brine Control	25	71	87	10.5	5
USBK01271	Brine Control	25	88			
USBK01271	Brine Control	25	91			
USBK01271	Brine Control	25	100			
USBK01271	Brine Control	25	87			
USSG01261	San Gabriel Flow	50	98	98	0.8	5
USSG01261	San Gabriel Flow	50	97			
USSG01261	San Gabriel Flow	50	99			
USSG01261	San Gabriel Flow	50	98			
USSG01261	San Gabriel Flow	50	99			
USSG01261	San Gabriel Flow	25	100	100	0.0	5
USSG01261	San Gabriel Flow	25	100			
USSG01261	San Gabriel Flow	25	100			
USSG01261	San Gabriel Flow	25	100			
USSG01261	San Gabriel Flow	25	100			
USSG01261	San Gabriel Flow	12	100	99	0.5	5
USSG01261	San Gabriel Flow	12	100			
USSG01261	San Gabriel Flow	12	99			
USSG01261	San Gabriel Flow	12	99			
USSG01261	San Gabriel Flow	12	99			
USSG01261	San Gabriel Flow	6	100	100	0.0	5
USSG01261	San Gabriel Flow	6	100			
USSG01261	San Gabriel Flow	6	100			
USSG01261	San Gabriel Flow	6	100			
USSG01261	San Gabriel Flow	6	100			
USSG01261	San Gabriel Flow	3	100	100	0.4	5
USSG01261	San Gabriel Flow	3	100			
USSG01261	San Gabriel Flow	3	100			
USSG01261	San Gabriel Flow	3	99			
USSG01261	San Gabriel Flow	3	100			
USSG01261	San Gabriel Flow	1.5	99	96	5.8	5
USSG01261	San Gabriel Flow	1.5	86			
USSG01261	San Gabriel Flow	1.5	100			
USSG01261	San Gabriel Flow	1.5	96			
USSG01261	San Gabriel Flow	1.5	99			

Table 3. Sea urchin fertilization results for experiment No. S403. Sample collected on 3/15/99 and tested on 3/16/99.

			Percent Fertilized			
Log No.	Description	Concentration (%)		Mean	Std Dev	N
USSW03161	Seawater Control		99	89	15.6	5
USSW03161	Seawater Control		98			
USSW03161	Seawater Control		91			
USSW03161	Seawater Control		62			
USSW03161	Seawater Control		97			
USBK03161	Brine Control	25	100	98	1.7	5
USBK03161	Brine Control	25	100			
USBK03161	Brine Control	25	98			
USBK03161	Brine Control	25	96			
USBK03161	Brine Control	25	98			
USBK03161	Brine Control	50	99	83	31.0	5
USBK03161	Brine Control	50	98			
USBK03161	Brine Control	50	96			
USBK03161	Brine Control	50	28			
USBK03161	Brine Control	50	96			
USLA03151	LA River Flow	1.5	99	87	16.8	5
USLA03151	LA River Flow	1.5	98			
USLA03151	LA River Flow	1.5	64			
USLA03151	LA River Flow	1.5	74			
USLA03151	LA River Flow	1.5	100			
USLA03151	LA River Flow	3	99	98	1.3	5
USLA03151	LA River Flow	3	96			
USLA03151	LA River Flow	3	99			
USLA03151	LA River Flow	3	99			
USLA03151	LA River Flow	3	99			
USLA03151	LA River Flow	6	99	98	1.9	5
USLA03151	LA River Flow	6	97			
USLA03151	LA River Flow	6	95			
USLA03151	LA River Flow	6	98			
USLA03151	LA River Flow	6	100			
USLA03151	LA River Flow	12.5	95	92	5.1	5
USLA03151	LA River Flow	12.5	94			
USLA03151	LA River Flow	12.5	85			
USLA03151	LA River Flow	12.5	88			
USLA03151	LA River Flow	12.5	97			
USLA03151	LA River Flow	25	36	40	6.6	5
USLA03151	LA River Flow	25	30			
USLA03151	LA River Flow	25	43			
USLA03151	LA River Flow	25	44			
USLA03151	LA River Flow	25	46			
USLA03151	LA River Flow	50	2	2	1.0	5
USLA03151	LA River Flow	50	3			
USLA03151	LA River Flow	50	3			
USLA03151	LA River Flow	50	1			
USLA03151	LA River Flow	50	1			

Table 4. Sea urchin fertilization results for experiment No. S409. Sample collected on 3/20/99 and tested on 3/22/99.

			Percent Fertilized			
Log No.	Description	Concentration (%)		Mean	Std Dev	N
USSW03221	Seawater Control		100	100	0.0	5
USSW03221	Seawater Control		100			
USSW03221	Seawater Control		100			
USSW03221	Seawater Control		100			
USSW03221	Seawater Control		100			
USBK03221	Brine Control	25	99	99	0.8	5
USBK03221	Brine Control	25	98			
USBK03221	Brine Control	25	100			
USBK03221	Brine Control	25	100			
USBK03221	Brine Control	25	99			
USBK03221	Brine Control	50	100	100	0.0	5
USBK03221	Brine Control	50	100			
USBK03221	Brine Control	50	100			
USBK03221	Brine Control	50	100			
USBK03221	Brine Control	50	100			
USLA03221	LA River Flow	1.5	100	100	0.4	5
USLA03221	LA River Flow	1.5	100			
USLA03221	LA River Flow	1.5	100			
USLA03221	LA River Flow	1.5	99			
USLA03221	LA River Flow	1.5	100			
USLA03221	LA River Flow	3	100	100	0.5	5
USLA03221	LA River Flow	3	100			
USLA03221	LA River Flow	3	99			
USLA03221	LA River Flow	3	99			
USLA03221	LA River Flow	3	100			
USLA03221	LA River Flow	6	99	100	0.4	5
USLA03221	LA River Flow	6	100			
USLA03221	LA River Flow	6	100			
USLA03221	LA River Flow	6	100			
USLA03221	LA River Flow	6	100			
USLA03221	LA River Flow	12.5	100	99	0.9	5
USLA03221	LA River Flow	12.5	98			
USLA03221	LA River Flow	12.5	100			
USLA03221	LA River Flow	12.5	100			
USLA03221	LA River Flow	12.5	99			
USLA03221	LA River Flow	25	100	99	0.8	5
USLA03221	LA River Flow	25	98			
USLA03221	LA River Flow	25	99			
USLA03221	LA River Flow	25	99			
USLA03221	LA River Flow	25	98			
USLA03221	LA River Flow	50	67	74	7.3	5
USLA03221	LA River Flow	50	75			
USLA03221	LA River Flow	50	80			
USLA03221	LA River Flow	50	67			
USLA03221	LA River Flow	50	83			

Table 5. Water quality summary for January 27, 1999 San Gabriel River fertilization test.

Log Number	Sample Name	Conc. (%)	Time Point	DO (mg/l)	Total Ammonia (mg/l)	Un-ionized Ammonia (mg/l)	Temperature (°C)	pH	Conductivity (mS/cm)	Cond. Sample Temp.	Salinity (g/Kg)
	Desired Range			>4.0	<20		14.0--16.0				32.0--34.0
USSW01271	Seawater Control		Initial	7.3	0.02	<0.001	14.2	7.78	50.6	21.0	32.8
USBK01271	Brine Control	50	Initial	7.4	0.09	0.001	14.2	7.75	50.6	20.2	32.7
USSG01261	San Gabriel River	50	Initial	7.0	2.01	0.028	14.2	7.83	51.4	19.7	33.3
USSG01261	San Gabriel River	12.5	Initial	7.2	0.48	0.008	14.2	7.89	51.5	20.5	33.4
USSG01261	San Gabriel River	3	Initial	6.9	0.11	0.002	14.2	7.91	51.6	20.4	33.5

Table 6. Water quality summary for March 16, 1999 LA River fertilization test.

Log Number	Sample Name	Conc. (%)	Time Point	DO (mg/l)	Total Ammonia (mg/l)	Un-ionized Ammonia (mg/l)	Temperature (°C)	pH	Conductivity (mS/cm)	Cond. Sample Temp.	Salinity (g/Kg)
	Desired Range			>4.0	<20		14.0--16.0				32.0--34.0
USSW03161	Seawater Control		Initial	7.2	0.02	<0.001	14.5	7.93	51.8	21.5	33.7
USBK03161	Brine Control	50	Initial	7.1	0.02	<0.001	14.5	7.99	49.9	21.7	32.4
USLA03151	Los Angeles River	50	Initial	7.4	0.03	0.001	14.5	7.96	51.5	21.6	33.5
USLA03151	Los Angeles River	12.5	Initial	7.3	0.10	0.002	14.5	8.00	51.1	21.5	33.2
USLA03151	Los Angeles River	3	Initial	7.5	0.45	0.014	14.5	8.16	49.9	21.5	32.4

Table 7. Water quality summary for March 22, 1999 LA River fertilization test.

Log Number	Sample Name	Conc. (%)	Time Point	DO (mg/l)	Total Ammonia (mg/l)	Un-ionized Ammonia (mg/l)	Temperature (°C)	pH	Conductivity (mS/cm)	Cond. Sample Temp.	Salinity (g/Kg)
	Desired Range			>4.0	<20		14.0--16.0				32.0--34.0
USSW03221	Seawater Control		Initial	7.4	0.02	<0.001	14.3	7.96	51.7	23.0	33.8
USBK03221	Brine Control	50	Initial	6.9	0.02	<0.001	14.3	8.00	50.0	23.3	32.6
USLA03221	Los Angeles River	50	Initial	6.8	0.04	0.001	14.3	7.94	51.3	23.3	33.5
USLA03221	Los Angeles River	12.5	Initial	6.8	0.11	0.002	14.3	7.98	50.8	23.4	33.2
USLA03221	Los Angeles River	3	Initial	6.7	0.41	0.010	14.3	8.15	49.7	23.3	32.4

Table 8. Sea urchin fertilization results for reference toxicant experiment No. S397 conducted on 1/27/99.

		Percent Fertilized			
Log Number	Description		Mean	Std Dev	N
USSW01272	Seawater Control	100	87	16.0	5
USSW01272	Seawater Control	100			
USSW01272	Seawater Control	90			
USSW01272	Seawater Control	85			
USSW01272	Seawater Control	61			
USRF01271	9.5 ug/l Cu	42	62	22.1	5
USRF01271	9.5 ug/l Cu	62			
USRF01271	9.5 ug/l Cu	98			
USRF01271	9.5 ug/l Cu	46			
USRF01271	9.5 ug/l Cu	63			
USRF01272	13.9 ug/l Cu	100	100	0.0	5
USRF01272	13.9 ug/l Cu	100			
USRF01272	13.9 ug/l Cu	100			
USRF01272	13.9 ug/l Cu	100			
USRF01272	13.9 ug/l Cu	100			
USRF01273	20.4 ug/l Cu	5	63	38.0	5
USRF01273	20.4 ug/l Cu	76			
USRF01273	20.4 ug/l Cu	88			
USRF01273	20.4 ug/l Cu	45			
USRF01273	20.4 ug/l Cu	99			
USRF01274	30.0 ug/l Cu	84	36	43.5	5
USRF01274	30.0 ug/l Cu	5			
USRF01274	30.0 ug/l Cu	6			
USRF01274	30.0 ug/l Cu	3			
USRF01274	30.0 ug/l Cu	84			
USRF01275	44.0 ug/l Cu	38	12	15.4	5
USRF01275	44.0 ug/l Cu	15			
USRF01275	44.0 ug/l Cu	1			
USRF01275	44.0 ug/l Cu	5			
USRF01275	44.0 ug/l Cu	2			
USRF01276	65.0 ug/l Cu	0	8	9.3	5
USRF01276	65.0 ug/l Cu	2			
USRF01276	65.0 ug/l Cu	4			
USRF01276	65.0 ug/l Cu	22			
USRF01276	65.0 ug/l Cu	14			

Table 9. Sea urchin fertilization results for reference toxicant experiment No. S404, conducted on 3/16/99.

		Percent Fertilized			
Log Number	Description		Mean	Std Dev	N
USSW03163	Seawater Control	98	98	1.2	5
USSW03163	Seawater Control	98			
USSW03163	Seawater Control	99			
USSW03163	Seawater Control	96			
USSW03163	Seawater Control	99			
USRF03161	9.5 ug/l Cu	99	96	2.9	5
USRF03161	9.5 ug/l Cu	92			
USRF03161	9.5 ug/l Cu	95			
USRF03161	9.5 ug/l Cu	99			
USRF03161	9.5 ug/l Cu	96			
USRF03162	13.9 ug/l Cu	98	94	3.0	5
USRF03162	13.9 ug/l Cu	92			
USRF03162	13.9 ug/l Cu	95			
USRF03162	13.9 ug/l Cu	93			
USRF03162	13.9 ug/l Cu	90			
USRF03163	20.4 ug/l Cu	75	83	6.8	5
USRF03163	20.4 ug/l Cu	78			
USRF03163	20.4 ug/l Cu	85			
USRF03163	20.4 ug/l Cu	86			
USRF03163	20.4 ug/l Cu	92			
USRF03164	30.0 ug/l Cu	76	72	8.5	5
USRF03164	30.0 ug/l Cu	82			
USRF03164	30.0 ug/l Cu	60			
USRF03164	30.0 ug/l Cu	67			
USRF03164	30.0 ug/l Cu	74			
USRF03165	44.0 ug/l Cu	3	12	17.5	5
USRF03165	44.0 ug/l Cu	7			
USRF03165	44.0 ug/l Cu	4			
USRF03165	44.0 ug/l Cu	43			
USRF03165	44.0 ug/l Cu	2			
USRF03166	65.0 ug/l Cu	1	1	0.7	5
USRF03166	65.0 ug/l Cu	1			
USRF03166	65.0 ug/l Cu	1			
USRF03166	65.0 ug/l Cu	2			
USRF03166	65.0 ug/l Cu	0			

Table 10. Sea urchin fertilization results for reference toxicant experiment No. S409, conducted on 3/22/99.

		Percent Fertilized			
Log Number	Description		Mean	Std Dev	N
USSW03223	Seawater Control	100	100	0.0	5
USSW03223	Seawater Control	100			
USSW03223	Seawater Control	100			
USSW03223	Seawater Control	100			
USSW03223	Seawater Control	100			
USRF03221	9.5 ug/l Cu	100	99	1.2	5
USRF03221	9.5 ug/l Cu	100			
USRF03221	9.5 ug/l Cu	99			
USRF03221	9.5 ug/l Cu	99			
USRF03221	9.5 ug/l Cu	97			
USRF03222	13.9 ug/l Cu	99	99	1.7	5
USRF03222	13.9 ug/l Cu	98			
USRF03222	13.9 ug/l Cu	100			
USRF03222	13.9 ug/l Cu	96			
USRF03222	13.9 ug/l Cu	100			
USRF03223	20.4 ug/l Cu	98	98	1.9	5
USRF03223	20.4 ug/l Cu	99			
USRF03223	20.4 ug/l Cu	95			
USRF03223	20.4 ug/l Cu	100			
USRF03223	20.4 ug/l Cu	97			
USRF03224	30.0 ug/l Cu	95	88	14.4	5
USRF03224	30.0 ug/l Cu	100			
USRF03224	30.0 ug/l Cu	85			
USRF03224	30.0 ug/l Cu	64			
USRF03224	30.0 ug/l Cu	95			
USRF03225	44.0 ug/l Cu	83	71	21.5	5
USRF03225	44.0 ug/l Cu	86			
USRF03225	44.0 ug/l Cu	53			
USRF03225	44.0 ug/l Cu	42			
USRF03225	44.0 ug/l Cu	89			
USRF03226	65.0 ug/l Cu	0	6	6.2	5
USRF03226	65.0 ug/l Cu	2			
USRF03226	65.0 ug/l Cu	6			
USRF03226	65.0 ug/l Cu	16			
USRF03226	65.0 ug/l Cu	8			

LOS ANGELES COUNTY RIVER TOXICITY REPORT: OCTOBER DRY WEATHER AND NOVEMBER WET WEATHER SAMPLES

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TOXICITY MEASUREMENT OF OCTOBER DRY WEATHER AND NOVEMBER 1998 WET WEATHER RIVER SAMPLES

INTRODUCTION

This report presents results for the toxicity analysis of samples of dry and wet weather flow from the Los Angeles and San Gabriel Rivers. The tests were conducted as partial fulfillment of the monitoring requirements mandated by NPDES Permit No. CAS614001 from the California Regional Water Quality Control Board (Los Angeles Region).

METHODS

Sampling was conducted during dry weather flow conditions at the Los Angeles and San Gabriel Rivers and during the first storm of the season on the San Gabriel River. The San Gabriel River dry weather sample was a 24 h, time weighted composite collected by autosampler on October 22, 1998. The Los Angeles River sample was a composite of 9 grabs collected manually by bucket over an 8 h period between 0800 and 1600 on October 22, 1998. The wet weather sample was collected by autosampler from the San Gabriel River on November 8, 1998. Sampling locations were LACDPW mass emission stations S-10 (Los Angeles River) and S-14 (San Gabriel River). Samples were stored under refrigeration until tested on October 23 and November 11, respectively.

Toxicity was measured using the purple sea urchin fertilization test as described by Chapman *et al*., 1995. Sea urchin gametes were obtained from specimens collected from a relatively uncontaminated area in northern Santa Monica Bay. In the test, sea urchin sperm are exposed to various concentrations of the test sample for 20 minutes at a temperature of 15 °C. Sea urchin eggs are then added to each sample and given 20 minutes for fertilization to occur. Preservative is then added to the samples, which are later examined with a microscope to determine the percentage of fertilized eggs.

Since the toxicity test uses a marine organism, the salinity of the river samples was adjusted to a typical seawater value by addition of hypersaline brine. Addition of the brine diluted the samples, restricting the highest concentration of sample tested to 50%. Additional test concentrations (25, 12, 6, 3, and 1.5%) were prepared by adding laboratory seawater (filtered natural seawater collected from offshore Redondo Beach) to the samples. A brine control was included in the experiment to check for toxicity introduced by the salinity adjustment procedure. The brine control consisted of deionized water, laboratory seawater, and brine at the same concentration found in the 50% and 25% river samples.

A reference toxicant test was conducted at the same time in order to document variability in test sensitivity. This test consisted of five concentrations of dissolved copper, ranging from 10 µg/L to 65 µg/L.

Water quality measurements (pH, dissolved oxygen, conductivity, and total ammonia) were made on the test samples at the beginning of the toxicity test. For the river samples, water quality was measured on the 50%, 12% and 3% concentrations. All measurements were made using electrodes. Sample salinity was calculated from the conductivity and temperature data. Un-ionized ammonia (NH_3) concentration was calculated from the total ammonia, pH, salinity, and temperature data.

For each experiment, we attempted to calculate an EC_{50} (concentration producing a 50% reduction in fertilization) and NOEC (highest test concentration that does not produce a statistically significant reduction in fertilization). The EC_{50} was calculated by probit analysis of the raw percent fertilized data. If there was less than a 50% reduction in fertilization success, then an EC_{50} could not be calculated. The NOEC was calculated by first arcsine transforming the percent fertilized data, then subjecting it a one way analysis of variance (ANOVA). If a significant difference between treatments was detected ($p \Leftrightarrow 0.05$), a Dunnett's multiple range test was performed to test for differences between the control value and each of the concentrations. If there was not a significant reduction in fertilization relative to the control, then a NOEC could not be calculated.

RESULTS AND DISCUSSION

Sea urchin fertilization was significantly reduced by exposure to the dry weather sample from the Los Angeles River (the 50% concentration had 64% of the eggs successfully fertilized), but no toxicity was detected for the San Gabriel River (the 50% concentration had 99% fertilization) (Figure 1). The NOEC for the Los Angeles River was 25% sample, which represents 4 chronic toxicity units (TU_c=100/NOEC). A NOEC could not be calculated for the San Gabriel River since there was no significant reduction in fertilization. Since samples from neither river caused a 50% reduction in fertilization, an EC_{50} could not be calculated (Table 1).

No toxicity was detected in the wet weather sample from San Gabriel River in November (Figure 2). Since there was no reduction in fertilization caused by this sample, neither a NOEC nor an EC_{50} could be calculated.

Summaries of the fertilization counts for each experiment are shown in Tables 3 and 4. For the first sampling, the control seawater fertilization percentage averaged 94% and the 50% brine control averaged 97%, well above the minimum acceptable value of 70%. The second sampling also had good control results with the seawater control averaging 89% and the 50% brine control greater than 99%.

The results of water quality measurements are shown in Tables 5 and 6. The pH, dissolved oxygen, and salinity of the samples were within acceptable ranges for both sets of experiments. Total ammonia in the San Gabriel River (3.51 mg /L) wet weather sample was elevated relative to the control, but was well below of the level (>20 mg /L) that would be expected to cause toxicity in the sea urchin fertilization test.

The reference toxicant tests associated with each exposure produced a fairly typical dose response. An EC_{50} of 52 µg/L was calculated for the first test and 19 µg /L for the second. The mean EC_{50} for our previous reference toxicant tests is 27.8 µg/L. The data for both tests is within the range for an acceptable test (3.2 to 52.4 µg/L). The results for the first exposure may indicate on average a slightly less sensitive test and the second exposure a slightly more sensitive test, but are both within the range seen by our laboratory and others using the same methods (Chapman *et al.*, 1995).

LITERATURE CITED

Chapman, G.A., D.L. Denton, and J.M. Lazorchak. 1995. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to west coast marine and estuarine organisms. EPA/600/R-95/136, National Exposure Research Laboratory, U. S. Environmental Protection Agency, Cincinnati, OH. 661p.

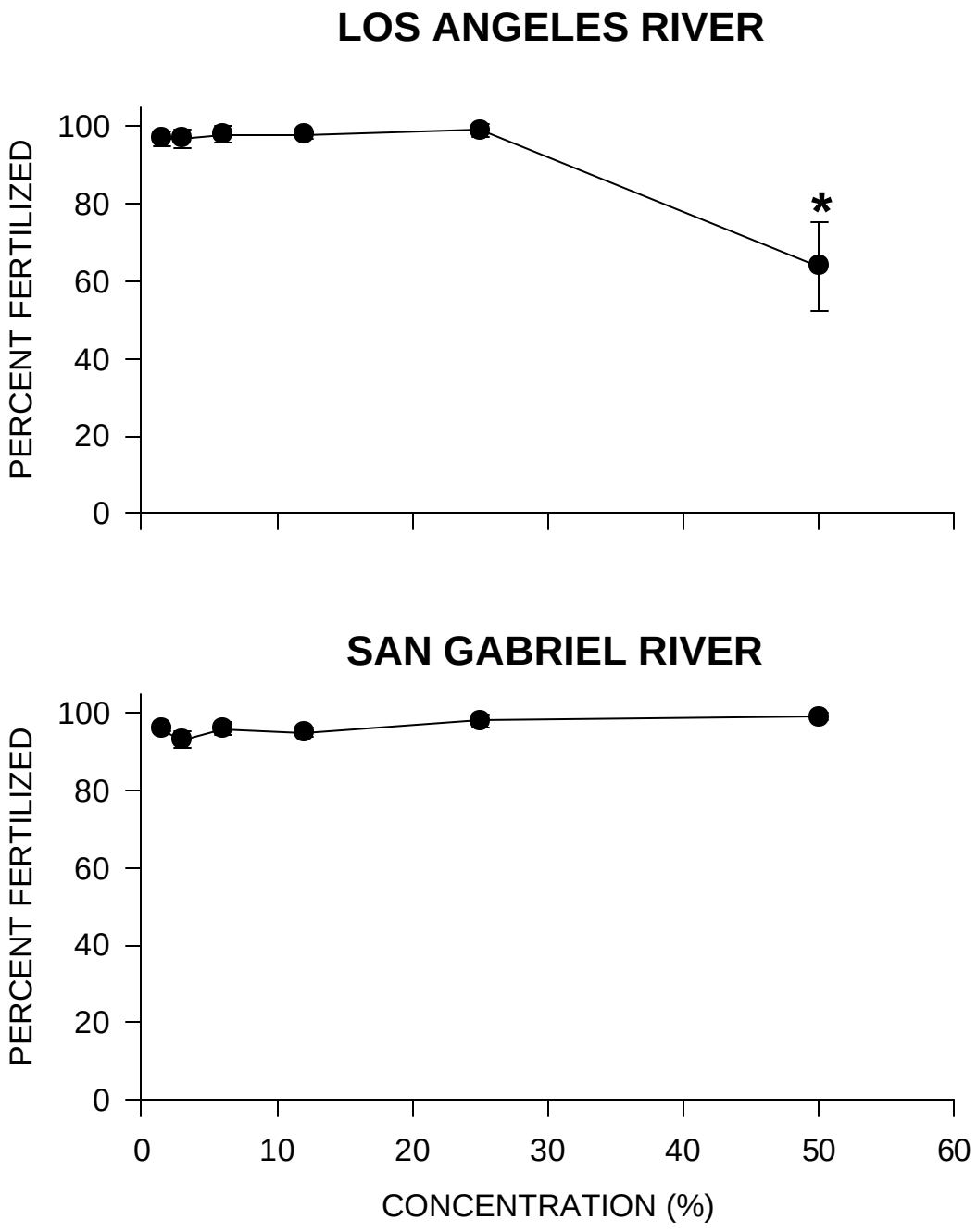

Figure 1. Dose-response plots of sea urchin fertilization test results for dry weather flow composites collected October 23, 1998. Symbols represent the mean of 5 and the standard deviation. Asterisks indicate samples with a statistically significant reduction in fertilization.

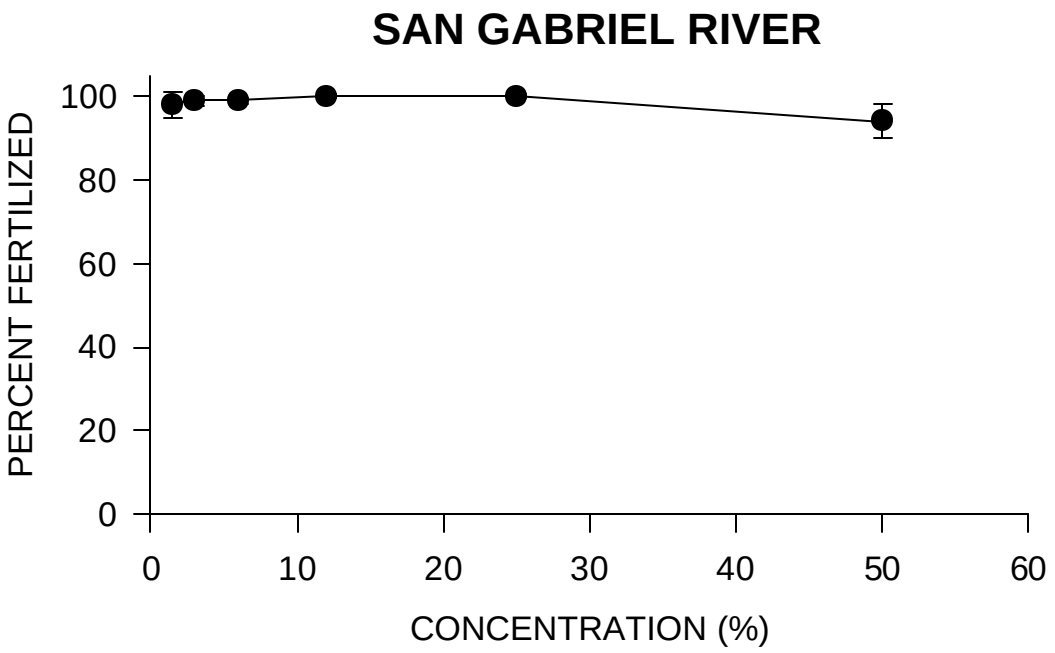

Figure 2. Dose-response plots of sea urchin fertilization test results for San Gabriel River wet weather flow composite collected November 8, 1998. Symbols represent the mean of 5 replicates and the standard deviation.

Table 1. Summary of sea urchin fertilization test results for river samples collected on November 26, 1997.

Location	EC50 (%)	NOEC (%)	Toxic units (TU_c)
Los Angeles River	>50	25	4
San Gabriel River	>50	⇩50	⇔2

Table 2. Summary of sea urchin fertilization test results for river sample collected on November 8, 1998.

Location	EC50 (%)	NOEC (%)	Toxic units (TU_c)
San Gabriel River	>50	⇩50	⇔2

Table 3. Sea Urchin Fertilization Results for Experiment No. S390 sampled on 10/22/98.

Log No.	Description	Concentration	Percent Fertilized	Mean	Std Dev	N
USSW10231	Seawater Control		98	94	2.7	5
USSW10231	Seawater Control		92			
USSW10231	Seawater Control		94			
USSW10231	Seawater Control		94			
USSW10231	Seawater Control		91			
USBK10232	Brine Control	50	93	97	2.7	5
USBK10232	Brine Control	50	100			
USBK10232	Brine Control	50	98			
USBK10232	Brine Control	50	99			
USBK10232	Brine Control	50	97			
USBK10232	Brine Control	25	96	95	2.2	5
USBK10232	Brine Control	25	93			
USBK10232	Brine Control	25	93			
USBK10232	Brine Control	25	98			
USBK10232	Brine Control	25	96			
USLA10231	LA River Flow	50	48	64	11.5	5
USLA10231	LA River Flow	50	61			
USLA10231	LA River Flow	50	74			
USLA10231	LA River Flow	50	59			
USLA10231	LA River Flow	50	76			
USLA10231	LA River Flow	25	96	99	1.5	5
USLA10231	LA River Flow	25	99			
USLA10231	LA River Flow	25	100			
USLA10231	LA River Flow	25	99			
USLA10231	LA River Flow	25	99			
USLA10231	LA River Flow	12	99	98	0.9	5
USLA10231	LA River Flow	12	97			
USLA10231	LA River Flow	12	99			
USLA10231	LA River Flow	12	99			
USLA10231	LA River Flow	12	98			
USLA10231	LA River Flow	6	99	98	2.3	5
USLA10231	LA River Flow	6	97			
USLA10231	LA River Flow	6	94			
USLA10231	LA River Flow	6	98			
USLA10231	LA River Flow	6	100			
USLA10231	LA River Flow	3	97	97	2.5	5
USLA10231	LA River Flow	3	96			
USLA10231	LA River Flow	3	93			
USLA10231	LA River Flow	3	99			
USLA10231	LA River Flow	3	99			
USLA10231	LA River Flow	1.5	98	97	1.9	5
USLA10231	LA River Flow	1.5	100			
USLA10231	LA River Flow	1.5	97			
USLA10231	LA River Flow	1.5	96			
USLA10231	LA River Flow	1.5	95			
USSG10231	San Gabriel Flow	50	99	99	1.0	5
USSG10231	San Gabriel Flow	50	98			
USSG10231	San Gabriel Flow	50	100			
USSG10231	San Gabriel Flow	50	100			
USSG10231	San Gabriel Flow	50	98			
USSG10231	San Gabriel Flow	25	96	98	1.5	5
USSG10231	San Gabriel Flow	25	98			
USSG10231	San Gabriel Flow	25	99			
USSG10231	San Gabriel Flow	25	98			
USSG10231	San Gabriel Flow	25	100			
USSG10231	San Gabriel Flow	12	97	95	1.1	5
USSG10231	San Gabriel Flow	12	94			
USSG10231	San Gabriel Flow	12	95			
USSG10231	San Gabriel Flow	12	96			
USSG10231	San Gabriel Flow	12	95			
USSG10231	San Gabriel Flow	6	98	96	1.8	5
USSG10231	San Gabriel Flow	6	95			
USSG10231	San Gabriel Flow	6	94			
USSG10231	San Gabriel Flow	6	98			
USSG10231	San Gabriel Flow	6	96			
USSG10231	San Gabriel Flow	3	92	93	2.1	5
USSG10231	San Gabriel Flow	3	93			
USSG10231	San Gabriel Flow	3	91			
USSG10231	San Gabriel Flow	3	96			
USSG10231	San Gabriel Flow	3	95			
USSG10231	San Gabriel Flow	1.5	96	95	2.2	5
USSG10231	San Gabriel Flow	1.5	95			
USSG10231	San Gabriel Flow	1.5	94			
USSG10231	San Gabriel Flow	1.5	98			

USSG10231	San Gabriel Flow	1.5	92

Table 4. Sea Urchin Fertilization Results for Experiment No. S393 sampled on 11/8/98.

Log Number	Description	Concentration	Percent Fertilized	Mean	Std Dev	N
USSW11111	Seawater Control		94	89	12.7	5
USSW11111	Seawater Control		99			
USSW11111	Seawater Control		95			
USSW11111	Seawater Control		90			
USSW11111	Seawater Control		67			
USBK11111	Brine Control	50	100	100	0.5	5
USBK11111	Brine Control	50	100			
USBK11111	Brine Control	50	100			
USBK11111	Brine Control	50	99			
USBK11111	Brine Control	50	99			
USBK11111	Brine Control	25	99	97	3.7	5
USBK11111	Brine Control	25	96			
USBK11111	Brine Control	25	91			
USBK11111	Brine Control	25	99			
USBK11111	Brine Control	25	100			
USSG11081	San Gabriel Flow	50	93	94	4.0	5
USSG11081	San Gabriel Flow	50	94			
USSG11081	San Gabriel Flow	50	92			
USSG11081	San Gabriel Flow	50	89			
USSG11081	San Gabriel Flow	50	100			
USSG11081	San Gabriel Flow	25	100	100	0.4	5
USSG11081	San Gabriel Flow	25	100			
USSG11081	San Gabriel Flow	25	99			
USSG11081	San Gabriel Flow	25	100			
USSG11081	San Gabriel Flow	25	100			
USSG11081	San Gabriel Flow	12	100	100	0.5	5
USSG11081	San Gabriel Flow	12	100			
USSG11081	San Gabriel Flow	12	100			
USSG11081	San Gabriel Flow	12	99			
USSG11081	San Gabriel Flow	12	99			
USSG11081	San Gabriel Flow	6	100	99	0.8	5
USSG11081	San Gabriel Flow	6	100			
USSG11081	San Gabriel Flow	6	99			
USSG11081	San Gabriel Flow	6	99			
USSG11081	San Gabriel Flow	6	98			
USSG11081	San Gabriel Flow	3	100	99	1.2	5
USSG11081	San Gabriel Flow	3	99			
USSG11081	San Gabriel Flow	3	97			
USSG11081	San Gabriel Flow	3	99			
USSG11081	San Gabriel Flow	3	100			
USSG11081	San Gabriel Flow	1.5	100	98	3.0	5
USSG11081	San Gabriel Flow	1.5	93			
USSG11081	San Gabriel Flow	1.5	100			
USSG11081	San Gabriel Flow	1.5	100			
USSG11081	San Gabriel Flow	1.5	99			

Table 5. Water quality summary for October dry weather sample fertilization test.

Log Number	Sample Name	Conc. (%)	Time Point	DO (mg/l)	Total Ammonia (mg/l)	Un-ionized Ammonia (mg/l)	Temperature (°C)	pH	Conductivity (mS/cm)	Cond. Sample Temp.	Salinity (g/Kg)
	Desired Range			>4.0	<20		14.0--16.0				32.0--34.0
USSW10231	Seawater Control		Initial	7.0	0.01	<0.001	15.0	7.96	50.5	21.3	32.8
USBK10232	Brine Control	50	Initial	6.9	0.01	<0.001	15.0	8.18	49.5	21.7	32.1
USLA10231	LA River	50	Initial	7.3	0.36	0.021	15.0	8.45	50.3	21.9	32.7
USLA10231	LA River	12.5	Initial	7.2	0.08	0.002	15.0	8.13	50.4	21.9	32.8
USLA10231	LA River	3	Initial	7.2	0.02	<0.001	15.0	7.99	50.3	21.6	32.7
USSG10231	San Gabriel River	50	Initial	6.9	0.02	0.001	15.0	8.13	50.8	21.9	33.1
USSG10231	San Gabriel River	12.5	Initial	6.9	0.03	0.001	15.0	8.01	50.4	22.1	32.8
USSG10231	San Gabriel River	3	Initial	6.8	0.03	0.001	15.0	7.98	50.2	22.2	32.6

Table 6. Water quality summary for November sample fertilization test.

Log Number	Sample Name	Conc. (%)	Time Point	DO (mg/l)	Total Ammonia (mg/l)	Un-ionized Ammonia (mg/l)	Temperature (°C)	pH	Conductivity (mS/cm)	Cond. Sample Temp.	Salinity (g/Kg)
	Desired Range			>4.0	<20		14.0--16.0				32.0--34.0
USSW11111	Seawater Control		Initial	7.2	0.02	<0.001	15.4	8.01	51.5	20.4	33.4
USBK11111	Brine Control	50	Initial	6.9	0.02	0.001	15.4	8.19	51.4	20.2	33.3
USSG11081	San Gabriel River	50	Initial	6.6	3.51	0.089	15.4	8.05	50.8	21.0	33.0
USSG11081	San Gabriel River	12.5	Initial	7.0	0.81	0.020	15.4	8.04	51.3	20.5	33.3
USSG12061	San Gabriel River	3	Initial	7.1	0.18	0.004	15.4	8.03	51.4	20.8	33.4

Table 7. Sea urchin fertilization results for reference toxicant experiment No. S392 conducted on 10/22/98.

		Percent Fertilized			
Log Number	Description		Mean	Std Dev	N Counted
USSW10233	Seawater Control	99	98	1.3	5
USSW10233	Seawater Control	96			
USSW10233	Seawater Control	98			
USSW10233	Seawater Control	99			
USSW10233	Seawater Control	99			
USRF10231	9.5 ug/l Cu	96	96	2.7	5
USRF10231	9.5 ug/l Cu	98			
USRF10231	9.5 ug/l Cu	92			
USRF10231	9.5 ug/l Cu	99			
USRF10231	9.5 ug/l Cu	96			
USRF10232	13.9 ug/l Cu	94	95	2.2	5
USRF10232	13.9 ug/l Cu	95			
USRF10232	13.9 ug/l Cu	94			
USRF10232	13.9 ug/l Cu	92			
USRF10232	13.9 ug/l Cu	98			
USRF10233	20.4 ug/l Cu	93	95	1.6	5
USRF10233	20.4 ug/l Cu	94			
USRF10233	20.4 ug/l Cu	96			
USRF10233	20.4 ug/l Cu	95			
USRF10233	20.4 ug/l Cu	97			
USRF10234	30.0 ug/l Cu	92	92	0.8	5
USRF10234	30.0 ug/l Cu	93			
USRF10234	30.0 ug/l Cu	92			
USRF10234	30.0 ug/l Cu	91			
USRF10234	30.0 ug/l Cu	91			
USRF10235	44.0 ug/l Cu	82	66	23.2	5
USRF10235	44.0 ug/l Cu	26			
USRF10235	44.0 ug/l Cu	69			
USRF10235	44.0 ug/l Cu	81			
USRF10235	44.0 ug/l Cu	74			
USRF10236	65.0 ug/l Cu	31	22	6.8	5
USRF10236	65.0 ug/l Cu	13			
USRF10236	65.0 ug/l Cu	18			
USRF10236	65.0 ug/l Cu	22			
USRF10236	65.0 ug/l Cu	25			

Table 8. Sea urchin fertilization results for reference toxicant experiment No. S394, conducted on 11/8/98.

		Percent Fertilized			
Log Number	**Description**		Mean	Std Dev	N Counted
USSW11112	Seawater Control	99	97	3.5	5
USSW11112	Seawater Control	99			
USSW11112	Seawater Control	93			
USSW11112	Seawater Control	93			
USSW11112	Seawater Control	100			
USRF11111	9.5 ug/l Cu	93	83	17.8	5
USRF11111	9.5 ug/l Cu	75			
USRF11111	9.5 ug/l Cu	56			
USRF11111	9.5 ug/l Cu	99			
USRF11111	9.5 ug/l Cu	94			
USRF11112	13.9 ug/l Cu	96	63	25.2	5
USRF11112	13.9 ug/l Cu	62			
USRF11112	13.9 ug/l Cu	65			
USRF11112	13.9 ug/l Cu	65			
USRF11112	13.9 ug/l Cu	25			
USRF11113	20.4 ug/l Cu	77	42	25.0	5
USRF11113	20.4 ug/l Cu	40			
USRF11113	20.4 ug/l Cu	55			
USRF11113	20.4 ug/l Cu	20			
USRF11113	20.4 ug/l Cu	17			
USRF11114	30.0 ug/l Cu	17	9	6.3	5
USRF11114	30.0 ug/l Cu	13			
USRF11114	30.0 ug/l Cu	2			
USRF11114	30.0 ug/l Cu	4			
USRF11114	30.0 ug/l Cu	7			
USRF11115	44.0 ug/l Cu	5	6	10.0	5
USRF11115	44.0 ug/l Cu	0			
USRF11115	44.0 ug/l Cu	1			
USRF11115	44.0 ug/l Cu	24			
USRF11115	44.0 ug/l Cu	2			
USRF11116	65.0 ug/l Cu	0	0	0.0	5
USRF11116	65.0 ug/l Cu	0			
USRF11116	65.0 ug/l Cu	0			
USRF11116	65.0 ug/l Cu	0			
USRF11116	65.0 ug/l Cu	0			

LOS ANGELES COUNTY RIVER TOXICITY REPORT: NOVEMBER AND DECEMBER WET WEATHER SAMPLES

Prepared for
Los Angeles County Department of Public Works

Prepared by
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January 6, 1997

TOXICITY MEASUREMENT OF NOVEMBER AND DECEMBER 1997 WET WEATHER RIVER SAMPLES

INTRODUCTION

This report presents results for the toxicity analysis of samples of wet weather flow from the Los Angeles and San Gabriel Rivers. The tests were conducted as partial fulfillment of the monitoring requirements mandated by NPDES Permit No. CAS614001 from the California Regional Water Quality Control Board (Los Angeles Region).

METHODS

Sampling was conducted during wet weather flow conditions at the Los Angeles and San Gabriel Rivers. The test samples were composites collected by autosampler on November 26 and December 6, 1997. Sampling locations were LACDPW mass emission stations S-10 (Los Angeles River) and S-14 (San Gabriel River). Samples were stored under refrigeration until tested on November 29 and December 9, respectively.

Toxicity was measured using the purple sea urchin fertilization test as described by Chapman *et al*., 1995. Sea urchin gametes were obtained from specimens collected from a relatively uncontaminated area in northern Santa Monica Bay. In the test, sea urchin sperm are exposed to various concentrations of the test sample for 20 minutes at a temperature of 15 °C. Sea urchin eggs are then added to each sample and given 20 minutes for fertilization to occur. Preservative is then added to the samples, which are later examined with a microscope to determine the percentage of fertilized eggs.

Since the toxicity test uses a marine organism, the salinity of the river samples was adjusted to a typical seawater value by addition of hypersaline brine. Addition of the brine diluted the samples, restricting the highest concentration of sample tested to 50%. Additional test concentrations (25, 12, 6, 3, and 1.5%) were prepared by adding laboratory seawater (filtered natural seawater collected from offshore Redondo Beach) to the samples. A brine control was included in the experiment to check for toxicity introduced by the salinity adjustment procedure. The brine control consisted of deionized water, laboratory seawater, and brine at the same concentration found in the 50% and 25% river samples.

A reference toxicant test was conducted at the same time in order to document variability in test sensitivity. This test consisted of five concentrations of dissolved copper, ranging from 10 µg/L to 65 µg/L.

Water quality measurements (pH, dissolved oxygen, conductivity, and total ammonia) were made on the test samples at the beginning of the toxicity test. Due to a malfunctioning ammonia electrode, total ammonia measurements were not made on the November 26 samples. For the river

samples, water quality was measured on the 50%, 12% and 3% concentrations. All measurements were made using electrodes. Sample salinity was calculated from the conductivity and temperature data. Un-ionized ammonia (NH_3) concentration was calculated from the total ammonia, pH, salinity, and temperature data.

A tiered approach was used to examine the river test samples. First, selected samples from the four highest concentrations (50, 25, and 12%) were examined to determine the pattern of dose response. Additional samples were then examined as needed to provide sufficient data for calculation of the EC_{50} (concentration producing a 50% reduction in fertilization) and NOEC (highest test concentration that does not produce a statistically significant reduction in fertilization). This procedure eliminated wasted effort spent examining samples that did not provide useful information about the level of toxicity.

RESULTS

Sea urchin fertilization was significantly reduced by exposure to the November samples from the Los Angeles and San Gabriel Rivers, as shown in Figure 1. The NOEC for each river was 25% sample, which represents 4 chronic toxicity units (TU_c=100/NOEC). The EC_{50} for the San Gabriel River was 32%, while the Los Angeles River was 27% (Table 1). There was no significant difference between the EC_{50} values, indicating that the magnitude of toxicity was similar for both sites.

Toxicity was again detected in samples from both rivers in December (Figure 2). While the NOEC was again 25% for each river, the EC_{50} data indicated a lower magnitude of toxicity was present. The EC_{50} for the Los Angeles River was 50%. The San Gabriel River could not be calculated since none of the samples produced less than 50% fertilization (Table 2).

Summaries of the fertilization counts for each experiment are shown in Tables 3 and 4. For the first sampling, the control seawater fertilization percentage averaged 87% and the 50% brine control averaged 89%, well above the minimum acceptable value of 70%. The second sampling also had good control results with the seawater control averaging 98% and the 50% brine control 99%.

The results of water quality measurements are shown in Tables 3 and 4. For the first exposure, we were unable to make ammonia measurements. The pH, dissolved oxygen, and salinity of the samples were within acceptable ranges. All parameters were within acceptable ranges for the second exposure. Total ammonia in the San Gabriel River sample was elevated relative to the control, but was less than 1% of that measured in a non-toxic dry weather sample from the same site.

The reference toxicant tests associated with each exposure produced a fairly typical dose response. An EC50 of 13 µg/L was calculated for the first test and 32 ug/L for the second. The data for the second test is within the range typically found in our laboratory. The results for the first exposure may indicate a slightly more sensitive test, but is within the range seen by other laboratories using the same methods (Chapman *et al.*, 1995).

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Chapman, G.A., D.L. Denton, and J.M. Lazorchak. 1995. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to west coast marine and estuarine organisms. EPA/600/R-95/136, National Exposure Research Laboratory, U. S. Environmental Protection Agency, Cincinnati, OH. 661p.

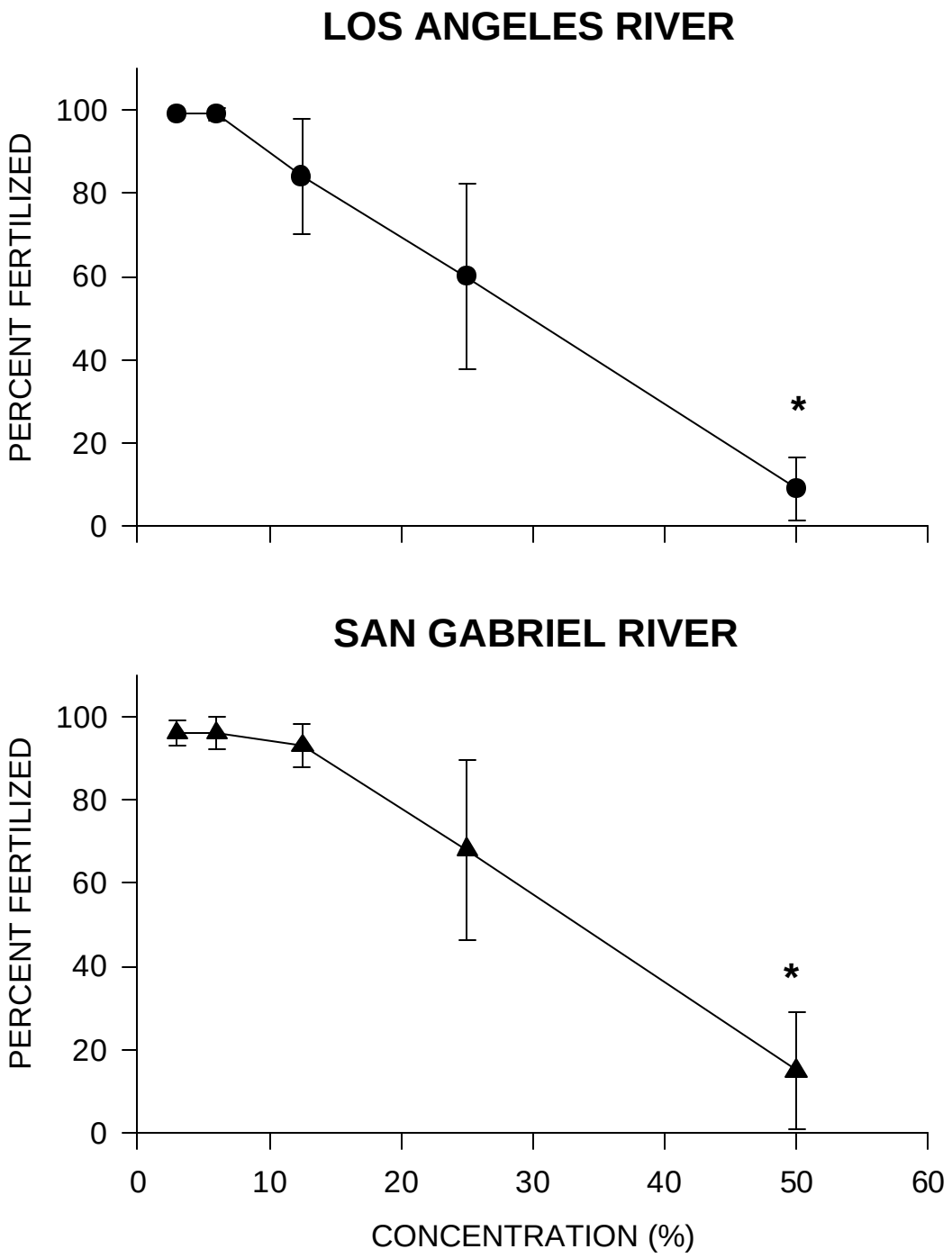

Figure 1. Dose-response plots of sea urchin fertilization test results for wet weather flow composites collected November 26, 1997. Symbols represent the mean of 5 replicates and the standard deviation. Asterisks indicate samples with a statistically significant reduction in fertilization.

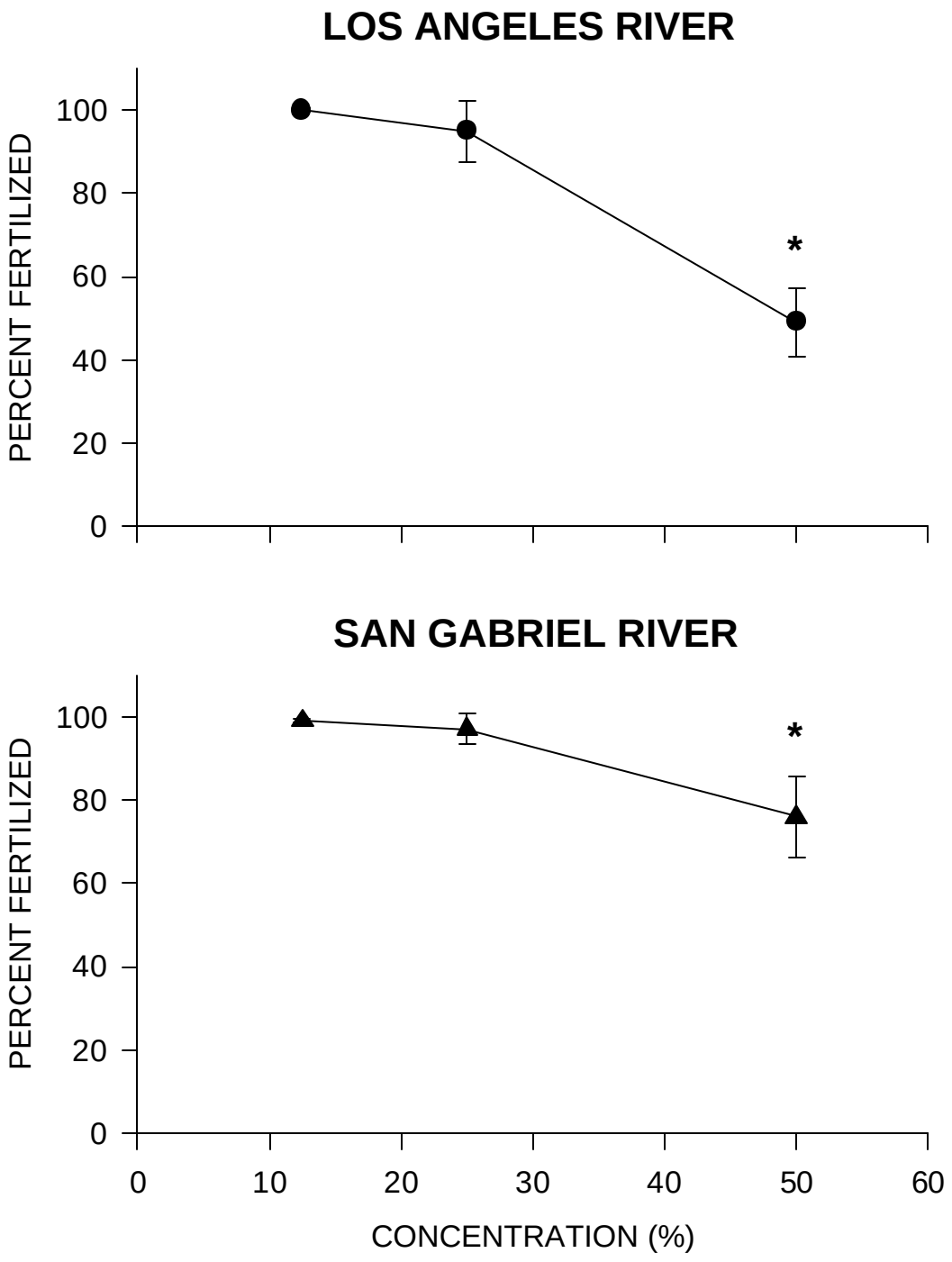

Figure 2. Dose-response plots of sea urchin fertilization test results for wet weather flow composites collected December 6, 1997. Symbols represent the mean of 5 replicates and the standard deviation. Asterisks indicate samples with a statistically significant reduction in fertilization.

Table 1. Summary of sea urchin fertilization test results for river samples collected on November 26, 1997.

Location	EC50 (%)	NOEC (%)	Toxic units (TU_c)
Los Angeles River	27	25	4
San Gabriel River	32	25	4

Table 2. Summary of sea urchin fertilization test results for river samples collected on December 6, 1997.

Location	EC50 (%)	NOEC (%)	Toxic units (TU_c)
Los Angeles River	50	25	4
San Gabriel River	>50	25	4

Table 5. Water quality summary for November sample fertilization test.

Log Number	Sample Name	Conc. (%)	Time Point	DO (mg/l)	Total Ammonia (mg/l)	Temperature (°C)	pH	Conductivity (mS/cm)	Cond. Sample Temp.	Salinity (g/KG)
USSW11291	Seawater Control		Initial	7.2		15.4	7.96	51.5	19.2	33.3
USBK11292	Brine Control	25	Initial	6.9		15.4	8.17	50.2	22.3	32.7
USLA11261	LA River	50	Initial	7.3		15.4	8.23	50.8	19.3	32.8
USLA11261	LA River	12.5	Initial	7.1		15.4	8.07	48.3	22.1	31.3
USLA11261	LA River	3	Initial	7.2		15.4	8.02	48.1	22.0	31.1
USSG11261	San Gabriel River	50	Initial	7.3		15.4	8.20	48.3	22.0	31.3
USSG11261	San Gabriel River	12.5	Initial	7.2		15.4	8.08	48.7	22.0	31.5
USSG11261	San Gabriel River	3	Initial	7.2		15.4	8.04	48.6	22.1	31.5

Table 6. Water quality summary for December sample fertilization test.

Log Number	Sample Name	Conc. (%)	Time Point	DO (mg/l)	Total Ammonia (mg/l)	Un-ionized Ammonia (mg/l)	Temperature (°C)	pH	Conductivity (mS/cm)	Cond. Sample Temp.	Salinity (g/KG)
USSW12091	Seawater Control		Initial	7.2	<0.06		14.5	7.75	49.8	20.7	32.2
USBK12091	Brine Control	50	Initial	7.2	0.02	0.001	14.5	8.11	50.1	20.9	32.5
USLA12061	LA River	50	Initial	7.0	0.25	0.008	14.5	8.16	50.1	19.4	32.3
USLA12061	LA River	12.5	Initial	7.0	0.09	0.001	14.5	7.86	49.4	20.9	31.9
USLA12061	LA River	3	Initial	6.9	<0.06		14.5	7.79	49.2	21.1	31.8
USSG12061	San Gabriel River	50	Initial	7.1	1.52	0.045	14.5	8.15	51.1	18.2	32.9
USSG12061	San Gabriel River	12.5	Initial	7.2	0.35	0.006	14.5	7.89	50.3	20.6	32.6
USSG12061	San Gabriel River	3	Initial	7.0	0.08	0.001	14.5	7.85	50.1	20.5	32.4