

SECTION 2

WATER

2.1 ROUTINE WATER COLUMN MONITORING

2.1.1 Collection Summary

Routine water column sampling was performed biweekly between May and October for a total of 13 sampling rounds. Water column samples were routinely collected from five locations (see **Figure 2-1**) - the Main Street Bridge in Massena (WCMSB), water column transect (WC) 007, Route 131 Bridge (WC131), WC011, and WC012. Water column samples were collected to continue monitoring PCB concentrations in the water column and document variation associated with location, season, flow, temperature, biological activity, and other variables.

During each event, samples were collected mid-channel at each location using a stainless steel Kemmerer water sampler as described in the 2002 SRS Work Plan (Alcoa, April 2002a). Due to shallow water depth at WCMSB, one sample was collected at 0.5 times the total water column depth. At WC007, WC131, WC011, and WC012, one sample was collected at 0.2 and 0.8 times the total water column depth (i.e., total of two samples per location). Sampling was performed via boat at all locations except WCMSB, where samples were collected from the Main Street Bridge as water depths and access limitations precluded collection with a boat.

In addition to the routine biweekly sampling, water column samples were collected from the Power Canal (WCPC) and at sediment probing Transect T11 (WCT11). One sample was collected WCPC during the week of June 19 to gather additional information on PCB levels in the Power Canal. This sample was collected via boat from mid-channel at 0.5 times the total water column depth (see **Figure 2-1**). Also, two samples were collected at WCT11 (**Figure 2-1**) during October (weeks of October 8 and 21). These samples were collected to supplement the existing water quality information at this location, as the transect was used as a boundary in the development of several remedial alternatives (Alcoa, June 2002). Samples were collected via boat from mid-channel at both 0.2 and 0.8 times the total water column depth.

At each location and prior to the collection of samples, the total water column depth was recorded and specific conductivity and temperature measurements obtained every two feet in the water column at mid-channel to check for the presence of stratification. Field measurements of pH, turbidity, and dissolved oxygen were also collected every two feet in the water column at mid-channel.

A total of 294 samples (including QA/QC samples) were packaged and shipped to Northeast Analytical, Inc. (NEA) in Schenectady, NY consistent with the methodologies outlined in the 2002 SRS Work Plan (Alcoa, April 2002a). Water column samples were analyzed for PCB congeners and total suspended solids (TSS). QA/QC sampling included the collection of an equipment rinse blank before and after each sampling round, and one duplicate and one matrix spike/matrix spike duplicate (MS/MSD) each month. The equipment rinse blanks and MS/MSD samples were analyzed for PCB congeners, and the duplicate samples were analyzed for PCB congeners and TSS. Therefore, a total of 166 samples were submitted to NEA for PCB congener analysis and a total of 128 samples were submitted for TSS analysis.

In addition, river flow rate measurements via velocity profiling were obtained concurrently with the collection of water column samples at WC001 (see **Figure 2-1** for location). Velocity profiling was conducted as detailed in the 2002 SRS Work Plan (Alcoa, April 2002a). Also, one tape down measurement (i.e., distance from bridge surface to water surface) was recorded at the Main Street Bridge during each water column round.

Table 2-1 provides a summary of all water column sampling rounds including sample locations and dates of collection.

2.1.2 Results

Water Column Monitoring Results

Routine water column monitoring data can be found on the CD-ROM in Appendix A in the data tables titled climate, riverflow_hist, riverflow_tapedown, water_field, and water_iupac. PCB and TSS results for 2002 also are listed in **Table 2-2**.

Flow and precipitation data measured in 2002 are shown in **Figure 2-2**. The average Grasse River flow estimated from the Oswegatchie River flow records was approximately 1,200 cubic feet per second (cfs), similar to the long-term average Grasse River flow of 1,100 cfs (Alcoa, April 2001). The 13 velocity profiles obtained in the river at WC001 resulted in an average estimated flow of about 830 cfs for 2002. With the exception of those measured during Rounds 4 (June 19) and 5 (July 1), estimated flows measured at WC001 during the spring and summer months were comparable to those estimated from Oswegatchie River flow records; during the fall, estimated flows from the Oswegatchie River flow records were higher than estimated flows from the Grasse River by about a factor of 2. The maximum flow estimated from the Oswegatchie River records occurred in April and was about 8,200 cfs, a typical spring flow for the lower Grasse River.

Precipitation was measured daily near Outfall 007 (see **Figure 2-1**). The total precipitation measured for 2002 was about 25 inches, lower than the average annual total by almost 9 inches.

Differences in temperature, conductivity and PCB concentration between surface (0.2 times the total water column depth) and deep (0.8 times the total water column depth) water samples were used to determine the presence of stratification in the lower Grasse River (**Figures 2-3, 2-4, and 2-5**). Temperature and conductivity data showed the river was stratified between mid-July and mid-August at WC007, WC131, WC011, and WC012; the lower water temperature and higher conductivity in deep water relative to the surface is the result of the inflow of colder water with higher conductivity from the St. Lawrence River along the river bottom. During this same time period, PCB levels in surface samples were generally lower than those measured in deep samples. PCB concentrations in the deeper water samples increased with distance from the mouth, presumably due to the longer exposure time to the diffusive flux from the surface sediments. These differences in temperature, conductivity, and PCB concentration are consistent with observations made during previous years (Alcoa, April 2001).

As in past years, PCB levels in water column samples from 2002 exhibit a seasonal pattern (**Figure 2-5**). Average PCB concentrations were below 30 nanograms per liter (ng/L) during the spring months, generally increased during the summer months (up to 100 ng/L) and then declined to less than 2 ng/L in the fall.

Water column PCB levels vary spatially in the lower Grasse River (**Figure 2-6**). During non-stratified periods, PCB levels generally increased from upstream to downstream. During times when the river was stratified (July to mid-September based on PCB levels), PCB concentrations were lowest at WCMSB (averaging 0.4 ng/L¹), peaked at WC007, WC131, or WC011, and declined at WC012. For example, average PCB concentrations on July 17 (Round 6) increased from 0.3 ng/L at WCMSB (river mile 8.0) to about 97 ng/L at WC131 (river mile 4.6), and then declined downstream to about 40 ng/L at WC012 (river mile 1.9). The decline in PCB levels between WC131 and WC012 is attributed to the dilution of Grasse River water with St. Lawrence River water during sampling.

As discussed previously, water column samples were collected at two additional locations in 2002: at WCPC (Power Canal) (one round in mid-June) and WCT11 (two rounds in October). Compared to results of other water column samples collected during the same round, the PCB levels measured at WCPC and WCT11 were low. The PCB concentration of the sample collected at WCPC was 1.9 ng/L whereas average concentrations in the Grasse River downstream of the Power Canal confluence ranged from 3 to 13 ng/L during the same survey. In the beginning of October, the average PCB concentration at WCT11 (11 ng/L) was 4 to 6 times lower than average concentrations measured at the downstream stations (i.e., WC007, WC131, WC011, and WC012). At the end of October, the average PCB level at WCT11 was near 1 ng/L, similar to the PCB levels observed downstream. PCB concentrations at the upstream location (i.e., WCMSB) were less than 1 ng/L for all three sampling rounds.

Average PCB homolog distributions of water samples collected at WC007, WC131, WC011, and WC012 show seasonal patterns; spring homolog distributions differ from those seen

¹Excludes one measurement of 15.8 ng/L reported during Round 5 (July 2). Laboratory contamination may have occurred during this round, as a PCB concentration of 10.3 ng/L was reported for the laboratory blank (rinse blanks had concentrations of 8.5 and 9.7 ng/L). Including this measurement, the average at WCMSB would be 1.6 ng/L.

in the summer and fall (**Figure 2-7**). In the spring, di-chlorinated biphenyls (CBs) and tri-CBs comprised most of the PCBs measured, averaging about 23 and 57 percent (%), respectively. In the summer and fall, the percentages of di- and tri-CBs were similar, each averaging about 41%. Mono-CBs were only observed during the summer months at WC007 and WC131 and comprised about 1% of the total PCBs observed at these locations.

TSS levels measured throughout the river remained relatively low regardless of river flow (**Figure 2-8**). At WCMSB, the average TSS concentration was 2.8 milligrams per liter (mg/L). TSS levels at WC007 and WC131 were slightly higher, averaging 4.0 and 3.7 mg/L, respectively. At WC011 and WC012, average TSS levels were similar and lower than those measured at WC007 and WC131 (3.1 mg/L and 2.9 mg/L, respectively). The highest TSS concentration of 9.5 mg/L was observed at WC007 in May (at a flow of about 1,600 cfs) at 0.8 times the total water column depth.

TSS concentrations in the Power Canal and at WCT11 also were low. The TSS concentration for the water sample collected in the Power Canal was 1 mg/L. The average TSS level measured at WCT11 during the last two sampling rounds was 4.7 mg/L (range of 3.0 to 6.1 mg/L).

Comparison to Historical Trends

Water column PCB levels exhibit an overall decline over the period of record (1995-2002) (**Figure 2-9**). These declines are partially explained by seasonal and year-to-year variations in river flow. However, the patterns also are evident in PCB mass flux (i.e., the product of PCB concentration and river flow), indicating that PCB sources to the river vary seasonally and have declined over time (**Figure 2-10**).

At water column Transect WC007, maximum summertime PCBs declined from 200 to 260 ng/L in 1995 to about 50 ng/L in 2002 (**Figure 2-9, top panel**). At water column Transect WC007A, maximum summertime PCB levels declined from about 300 ng/L in 1995 to about 100 ng/L in 2002 (2000-02 samples collected from Route 131 Bridge located about 500 feet

upstream of Transect WC007A; **Figure 2-9, middle panel**). Finally, maximum PCB levels measured at water column Transect WC011 in summer 2002 are about 3 times lower than those observed in summer 1995 (**Figure 2-9, bottom panel**). Patterns in PCB mass flux over time are similar to those of the PCB concentrations at all three locations (**Figure 2-10**).

2.2 SEMI-PERMEABLE MEMBRANE DEVICES

2.2.1 Collection Summary

SPMDs were deployed monthly within the river between May and October and retrieved approximately two weeks later, following the procedure outlined in the 2002 SRS Work Plan (Alcoa, April 2002a). All deployment and retrieval activities were performed concurrently with the routine water column sampling rounds and locations. These devices were used to continue Alcoa's evaluation of SPMDs as surrogates to monitor dissolved PCBs in the water column over time.

A total of six SPMD deployment/retrieval rounds were conducted in 2002 (**Table 2-1** provides additional detail). Two SPMDs were deployed mid-channel at each of water column transects WC007, WC131, WC011, and WC012: one at 0.2 and one at 0.8 times the total water column depth. Due to water depth limitations and access restrictions at the Main Street Bridge, one SPMD was deployed upstream of the Main Street Bridge at WC001 at 0.5 times the total water column depth (**Figure 2-1**).

SPMDs also were deployed/retrieved at WCT11 during the October sampling rounds to supplement existing water quality information at this location. One SPMD was placed at both 0.2 and 0.8 times the total water column depth for each round (i.e., two samples) at this location.

During retrieval of SPMDs at WC012 on July 17, 2002 (Round 6), it was observed that the cage set at 0.2 times the total water column depth was destroyed/damaged during the deployment period. As a result, this sample was not submitted to the laboratory for analysis.

A total of 67 SPMDs (including QA/QC samples) were retrieved, packaged, and sent to Environmental Sampling Technologies (EST) in St. Joseph, Missouri (MO) for extraction according to the 2002 SRS Work Plan (Alcoa, April 2002a). The extracts were then sent to NEA for PCB congener analysis. One trip blank and one duplicate was collected per round (i.e., once per month) for PCB congener analysis.

2.2.2 Results

SPMD data can be found on the CD-ROM in Appendix A in the data table titled `spmd_bz`. PCB results also are listed in **Table 2-3**.

PCB levels in SPMDs exhibit a similar seasonal pattern to those observed in the water column (**Figure 2-11**). At WC007, WC131, WC011, and WC012, average PCB levels were about 9 micrograms per SPMD ($\mu\text{g}/\text{SPMD}$) (ranging from 2 to 17 $\mu\text{g}/\text{SPMD}$) during the spring months and generally increased during the summer months (averaging about 20 $\mu\text{g}/\text{SPMD}$ and ranging between 13 and 25 $\mu\text{g}/\text{SPMD}$). During the fall, average PCB levels were about 17 $\mu\text{g}/\text{SPMD}$ (range of 5 to 33 $\mu\text{g}/\text{SPMD}$). At WC001, SPMDs also exhibited a similar seasonal pattern to that observed in the water column; the average PCB level at this location was 0.13 $\mu\text{g}/\text{SPMD}$ (range of 0.09 to 0.14 $\mu\text{g}/\text{SPMD}$).

Similar to the water column PCB data, SPMD PCB levels vary spatially in the lower Grasse River (**Figure 2-12**). During non-stratified periods, PCB levels generally increased from upstream to downstream. The average PCB mass in SPMDs deployed at WC001 was low (0.13 $\mu\text{g}/\text{SPMD}$). At WC131, average PCB levels increased to about 11 $\mu\text{g}/\text{SPMD}$, with individual measurements ranging from 4.8 to 23.8 $\mu\text{g}/\text{SPMD}$ at WC131. Further downstream at WC011, PCB levels generally increased to an average of about 15 $\mu\text{g}/\text{SPMD}$ during the spring and fall months. At WC012, the average PCB level was about 19 $\mu\text{g}/\text{SPMD}$. During times when the river was stratified, PCB levels increased to about WC131 or WC011 and then declined with distance downstream (Sets 3 and 4); in July (Set 3), relative percent differences in PCB levels between surface and deep samples at WC007 and WC131 were 125% and 79%, respectively; in August (Set 4), their differences were 36% and 29%, respectively.

As discussed previously, SPMD samples were deployed at WCT11 in October 2002. Compared to results of other SPMD samples collected during the same period, the PCB levels measured at WCT11 were low. The average PCB concentration at WCT11 (4.1 $\mu\text{g}/\text{SPMD}$ at river mile 5.8) was 1.5 to 4 times lower than average concentrations measured at the downstream stations (i.e., WC007, WC131, WC011, and WC012) and follows the spatial trend expected during non-stratified periods (**Figure 2-12**).

Average PCB homolog distributions of SPMD samples collected at WC007, WC131, WC011, and WC012 were similar during all three seasons -- spring, summer, and fall (**Figure 2-13**). Tri- and di-CBs dominated the homolog distributions, averaging about 39 and 28%, respectively. Mono-CBs were, on average, slightly higher in the fall (about 5% of total PCBs) than in the spring (about 4% of total PCBs) and summer (about 3% of total PCBs).

**GRASSE RIVER STUDY AREA
MASSENA, NEW YORK**

**Table 2-1
2002 Supplemental Remedial Studies Program - Summary Report
2002 Water Column Collection Summary**

Round Number	Sample Collection Date(s)	Water Column Transects/SPMD Sample Locations ^{1,2}							Velocity Measurement WC001 (Transect 001)
		WCMSB ³ (Main Street Bridge)	WCT11 (Sediment Probing Transect T11)	WC007 (Water Column Transect 007)	WC131 (Route 131 Bridge)	WC011 (Water Column Transect 011)	WC012 (Water Column Transect 012)	WCPC (Power Canal)	
1	5/6/02-5/7/02	WC	---	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	---	V SPMD Deploy
2	5/20/02-5/21/02	WC	---	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	---	V SPMD Retrieve
3	6/6/02	WC	---	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	---	V SPMD Deploy
4	6/19/02	WC	---	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	WC	V SPMD Retrieve
5	7/1/02-7/2/02	WC	---	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	---	V SPMD Deploy
6	7/16/02-7/17/02	WC	---	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve ⁴	---	V SPMD Retrieve
7 ⁵	8/1/02	WC	---	WC	WC	WC	WC	---	V
8	8/12/02	WC	---	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	---	V SPMD Deploy
9	8/28/02	WC	---	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	---	V SPMD Retrieve
10	9/11/02	WC	---	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	---	V SPMD Deploy
11	9/24/02	WC	---	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	---	V SPMD Retrieve
12	10/8/02	WC	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	WC SPMD Deploy	---	V SPMD Deploy
13	10/21/02	WC	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	WC SPMD Retrieve	---	V SPMD Retrieve

Notes:

1. Sample locations provided on Figure 2-1.
2. WC indicates water column samples collected.
SPMD Deploy/Retrieve indicates SPMDs were placed or removed from the specified sample location.
V indicates a velocity profile was performed.
--- indicates no samples were collected/deployed.
3. Tape down measurements were collected from the Main Street Bridge during each water column round except for round 10 on 9/11/02.
4. SPMD set at 0.2 times the total water column depth was destroyed/damaged during deployment period; sample not submitted for analysis.
5. No SPMDs were deployed during this round as the August monthly SPMD deployment/retrieval occurred in association with the next two water column rounds (3 water column monitoring rounds occurred in August).

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Table 2-2
2002 Supplemental Remedial Studies Program - Summary Report
Routine Water Column Monitoring Data
Subset of data table: water_iupac

Round	Month	Day	Transect	Fraction of Total	Duplicate	Total Water		Total PCBs [ng/L]	TSS [mg/L]
				Water Column Depth		Depth [ft]	Sample Depth [ft]		
1	5	7	WC-MSB	0.5		5.9	3.0	0.21	2.50
1	5	7	WC-007	0.2		15.0	3.0	10.30	9.02
1	5	7	WC-007	0.8		15.0	12.0	11.53	9.52
1	5	7	WC-131	0.2		22.0	4.4	8.70	4.54
1	5	7	WC-131	0.8		22.0	17.6	15.96	6.99
1	5	7	WC-011	0.2		15.0	3.0	20.70	4.06
1	5	7	WC-011	0.8		15.0	12.0	16.18	4.70
1	5	7	WC-011	0.8	DUP	15.0	12.0	31.21	---
1	5	7	WC-012	0.2		15.0	3.0	28.66	3.60
1	5	7	WC-012	0.8		15.0	12.0	26.26	3.10
2	5	21	WC-MSB	0.5		6.3	3.2	0.27	3.60
2	5	21	WC-007	0.2		15.5	3.1	3.34	3.70
2	5	21	WC-007	0.8		15.5	12.4	5.67	3.80
2	5	21	WC-131	0.2		22.5	4.5	4.93	3.60
2	5	21	WC-131	0.8		22.5	18.0	6.04	4.40
2	5	21	WC-011	0.2		16.0	3.2	13.13	3.00
2	5	21	WC-011	0.8		16.0	12.8	12.63	3.50
2	5	21	WC-011	0.8	DUP	16.0	12.8	---	3.50
2	5	21	WC-012	0.8		16.0	12.8	12.80	3.40
2	5	21	WC-012	0.2		16.0	3.2	10.61	3.40
3	6	6	WC-MSB	0.5		5.5	2.8	0.26	2.50
3	6	6	WC-007	0.2		14.0	2.8	1.59	2.10
3	6	6	WC-007	0.8		14.0	11.2	2.73	2.60
3	6	6	WC-007	0.8	DUP	14.0	11.2	3.78	3.20
3	6	6	WC-131	0.2		21.0	4.2	13.08	2.40
3	6	6	WC-131	0.8		21.0	16.8	9.12	3.60
3	6	6	WC-011	0.2		15.0	3.0	20.31	2.60
3	6	6	WC-011	0.8		15.0	12.0	26.82	3.70
3	6	6	WC-012	0.2		14.0	2.8	20.98	2.00
3	6	6	WC-012	0.8		14.0	11.2	32.71	2.90
4	6	19	WC-MSB	0.5		6.1	3.1	0.71	5.60
4	6	19	WC-007	0.2		14.0	2.8	3.43	3.20
4	6	19	WC-007	0.8		14.0	11.2	21.89	3.60
4	6	19	WC-131	0.2		22.0	4.4	3.46	2.60
4	6	19	WC-131	0.8		22.0	17.6	3.31	3.86
4	6	19	WC-011	0.2		15.0	3.0	3.42	2.74
4	6	19	WC-011	0.8		15.0	12.0	4.11	3.26
4	6	19	WC-012	0.2		14.0	2.8	4.87	2.20
4	6	19	WC-012	0.8		14.0	11.2	11.27	3.40
4	6	19	WC-PC	0.5		31.0	15.5	1.88	1.00

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Table 2-2
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Routine Water Column Monitoring Data
Subset of data table: water_iupac

Round	Month	Day	Transect	Fraction of Total	Duplicate	Total Water	Sample Depth [ft]	Total PCBs [ng/L]	TSS [mg/L]
				Water Column Depth		Depth [ft]			
5	7	2	WC-MSB	0.5		5.8	2.9	15.85	4.84
5	7	2	WC-007	0.2		15.0	3.0	8.88	5.19
5	7	2	WC-007	0.8		15.0	12.0	20.06	6.27
5	7	2	WC-007	0.8	DUP	15.0	12.0	10.19	5.47
5	7	2	WC-131	0.2		22.0	4.4	7.18	5.62
5	7	2	WC-131	0.8		22.0	17.6	20.81	5.84
5	7	2	WC-011	0.2		15.0	3.0	33.73	4.13
5	7	2	WC-011	0.8		15.0	12.0	29.25	5.60
5	7	2	WC-012	0.2		15.0	3.0	22.08	4.13
5	7	2	WC-012	0.8		15.0	12.0	18.27	3.87
6	7	16	WC-MSB	0.5		4.0	2.0	0.29	1.00
6	7	17	WC-007	0.2		14.0	2.8	45.59	2.80
6	7	17	WC-007	0.8		14.0	11.2	94.74	2.20
6	7	17	WC-131	0.2		21.0	4.2	97.24	3.43
6	7	17	WC-131	0.8		21.0	16.8	95.68	2.10
6	7	17	WC-011	0.2		13.0	2.6	46.54	2.31
6	7	17	WC-011	0.8		13.0	11.4	55.82	2.30
6	7	17	WC-012	0.2		15.0	3.0	44.50	1.90
6	7	17	WC-012	0.8		15.0	12.0	34.98	1.90
7	8	1	WC-MSB	0.5		4.0	2.0	0.21	-1.00
7	8	1	WC-007	0.2		15.0	3.0	16.77	2.00
7	8	1	WC-007	0.8		15.0	12.0	75.36	2.10
7	8	1	WC-131	0.2		21.0	4.2	23.12	1.10
7	8	1	WC-131	0.8		21.0	16.8	62.55	-1.00
7	8	1	WC-011	0.2		14.0	2.8	24.08	1.60
7	8	1	WC-011	0.8		14.0	11.2	38.25	1.50
7	8	1	WC-012	0.2		15.0	3.0	35.28	1.70
7	8	1	WC-012	0.8		15.0	12.0	28.01	1.30
8	8	12	WC-MSB	0.5		4.0	2.0	0.51	1.50
8	8	12	WC-007	0.2		15.0	3.0	43.34	2.20
8	8	12	WC-007	0.8		15.0	12.0	130.58	3.50
8	8	12	WC-131	0.2		21.0	4.2	38.61	2.20
8	8	12	WC-131	0.2	DUP	21.0	4.2	50.14	2.10
8	8	12	WC-131	0.8		21.0	16.8	115.35	1.70
8	8	12	WC-011	0.2		15.0	3.0	58.68	1.30
8	8	12	WC-011	0.8		15.0	12.0	71.77	1.50
8	8	12	WC-012	0.2		15.0	3.0	52.12	1.80
8	8	12	WC-012	0.8		15.0	12.0	60.41	1.60
9	8	28	WC-MSB	0.5		4.0	2.0	0.77	1.50
9	8	28	WC-007	0.2		16.0	3.2	46.17	3.62
9	8	28	WC-007	0.8		16.0	12.8	34.99	2.70
9	8	28	WC-131	0.2		22.0	4.4	52.59	2.11
9	8	28	WC-131	0.8		22.0	17.6	50.63	3.10
9	8	28	WC-011	0.2		16.0	3.2	62.03	3.40
9	8	28	WC-011	0.8		16.0	12.8	69.55	2.10
9	8	28	WC-012	0.2		16.0	3.2	59.26	2.50
9	8	28	WC-012	0.8		16.0	12.8	61.22	3.10

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Table 2-2
2002 Supplemental Remedial Studies Program - Summary Report
Routine Water Column Monitoring Data
Subset of data table: water_iupac

Round	Month	Day	Transect	Fraction of Total	Total Water		Total PCBs [ng/L]	TSS [mg/L]	
				Water Column Depth	Duplicate	Depth [ft]			Sample Depth [ft]
10	9	11	WC-MSB	0.5		3.7	1.4	0.73	1.00
10	9	11	WC-007	0.2		16.0	3.2	42.66	3.60
10	9	11	WC-007	0.8		16.0	12.8	44.31	4.60
10	9	11	WC-131	0.2		21.0	4.2	55.76	4.20
10	9	11	WC-131	0.2	DUP	21.0	4.2	57.06	4.00
10	9	11	WC-131	0.8		21.0	16.8	81.67	4.00
10	9	11	WC-011	0.2		16.0	3.2	78.31	2.50
10	9	11	WC-011	0.8		16.0	12.8	58.35	2.50
10	9	11	WC-012	0.2		16.0	3.2	59.85	3.80
10	9	11	WC-012	0.8		16.0	12.8	56.88	2.90
11	9	24	WC-MSB	0.5		4.0	2.0	0.32	1.40
11	9	24	WC-007	0.2		15.0	3.0	34.53	2.50
11	9	24	WC-007	0.8		15.0	12.0	40.33	2.90
11	9	24	WC-131	0.2		22.0	4.4	41.97	2.80
11	9	24	WC-131	0.8		22.0	17.6	45.28	2.00
11	9	24	WC-011	0.2		15.0	3.0	41.77	1.80
11	9	24	WC-011	0.8		15.0	12.0	39.40	2.10
11	9	24	WC-012	0.2		15.0	3.0	47.90	3.30
11	9	24	WC-012	0.8		15.0	12.0	49.90	2.40
12	10	8	WC-MSB	0.5		4.0	2.0	0.30	3.40
12	10	8	WC-007	0.2		15.0	3.0	54.17	3.80
12	10	8	WC-007	0.8		15.0	12.0	85.37	5.10
12	10	8	WC-131	0.2		22.0	4.4	37.58	6.50
12	10	8	WC-131	0.8		22.0	17.6	46.72	6.60
12	10	8	WC-011	0.2		15.0	3.0	60.18	3.20
12	10	8	WC-011	0.8		15.0	12.0	45.45	2.80
12	10	8	WC-012	0.2		14.0	2.6	48.43	3.60
12	10	8	WC-012	0.8		14.0	10.4	70.04	3.10
12	10	8	WC-T11	0.2		12.0	2.4	15.95	3.40
12	10	8	WC-T11	0.2	DUP	12.0	2.4	13.19	4.70
12	10	8	WC-T11	0.8		12.0	9.6	6.60	3.00
13	10	21	WC-MSB	0.5		5.5	2.8	0.22	6.20
13	10	21	WC-007	0.2		15.0	3.0	1.40	6.10
13	10	21	WC-007	0.8		15.0	12.0	0.94	4.90
13	10	21	WC-131	0.2		22.0	4.4	0.68	4.70
13	10	21	WC-131	0.8		22.0	17.8	1.40	6.60
13	10	21	WC-011	0.2		15.0	3.0	0.96	5.80
13	10	21	WC-011	0.8		15.0	12.0	0.80	6.90
13	10	21	WC-012	0.2		14.0	2.8	3.30	4.00
13	10	21	WC-012	0.8		14.0	11.2	4.89	3.90
13	10	21	WC-T11	0.2		12.0	2.4	1.45	5.50
13	10	21	WC-T11	0.8		12.0	9.6	0.27	6.10

Notes:

1. Negative numbers indicate the concentration was reported below the detection limit (DL), i.e. -1.00 means the concentration was less than the DL of 1.00 milligrams per liter
2. --- indicates parameter not measured as duplicate samples for each parameter (1 per month required) were collected in different sampling rounds occurring in the same month
3. If a sample is a duplicate sample, DUP is listed under Duplicate

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

Table 2-3
2002 Supplemental Remedial Studies - Summary Report
SPMD Data
Subset of data table: spmd_bz

Set	Exposure Period	Transect	Fraction of Total Water Depth	Duplicate	Total Water Depth [ft]	Sample Depth [feet]	Total PCBs [ug]
1	5/6 - 5/20	SPMD-001	0.5		5.9	3.0	0.13
1	5/7 - 5/21	SPMD-007	0.2		15.0	3.0	5.82
1	5/7 - 5/21	SPMD-007	0.8		15.0	12.0	5.89
1	5/7 - 5/21	SPMD-007	0.8	DUP	15.0	12.0	5.20
1	5/7 - 5/21	SPMD-131	0.2		22.0	4.4	9.37
1	5/7 - 5/21	SPMD-131	0.8		22.0	17.6	7.44
1	5/7 - 5/21	SPMD-011	0.2		15.0	3.0	10.77
1	5/7 - 5/21	SPMD-011	0.8		15.0	12.0	15.55
1	5/7 - 5/21	SPMD-012	0.2		15.0	3.0	18.22
1	5/7 - 5/21	SPMD-012	0.8		15.0	12.0	16.07
2	6/6 - 6/19	SPMD-001	0.5		5.2	2.6	0.15
2	6/6 - 6/19	SPMD-007	0.2		14.0	2.8	2.12
2	6/6 - 6/19	SPMD-007	0.8		14.0	11.2	2.16
2	6/6 - 6/19	SPMD-007	0.8	DUP	14.0	11.2	2.62
2	6/6 - 6/19	SPMD-131	0.2		21.0	4.2	4.99
2	6/6 - 6/19	SPMD-131	0.8		21.0	16.8	4.80
2	6/6 - 6/19	SPMD-011	0.2		15.0	3.0	9.62
2	6/6 - 6/19	SPMD-011	0.8		15.0	12.0	7.99
2	6/6 - 6/19	SPMD-012	0.2		14.0	2.8	12.54
2	6/6 - 6/19	SPMD-012	0.8		14.0	11.2	10.33
3	7/1 - 7/16	SPMD-001	0.5		5.8	2.9	0.14
3	7/2 - 7/17	SPMD-007	0.2		15.0	3.0	5.03
3	7/2 - 7/17	SPMD-007	0.8		15.0	12.0	23.57
3	7/2 - 7/17	SPMD-007	0.8	DUP	15.0	12.0	19.77
3	7/2 - 7/17	SPMD-131	0.2		22.0	4.4	13.59
3	7/2 - 7/17	SPMD-131	0.8		22.0	17.6	31.23
3	7/2 - 7/17	SPMD-011	0.2		15.0	3.0	15.45
3	7/2 - 7/17	SPMD-011	0.8		15.0	12.0	15.65
3	7/2 - 7/17	SPMD-012	0.2		15.0	3.0	(1)
3	7/2 - 7/17	SPMD-012	0.8		15.0	12.0	16.90

**GRASSE RIVER STUDY AREA
MASSENA, NEW YORK**

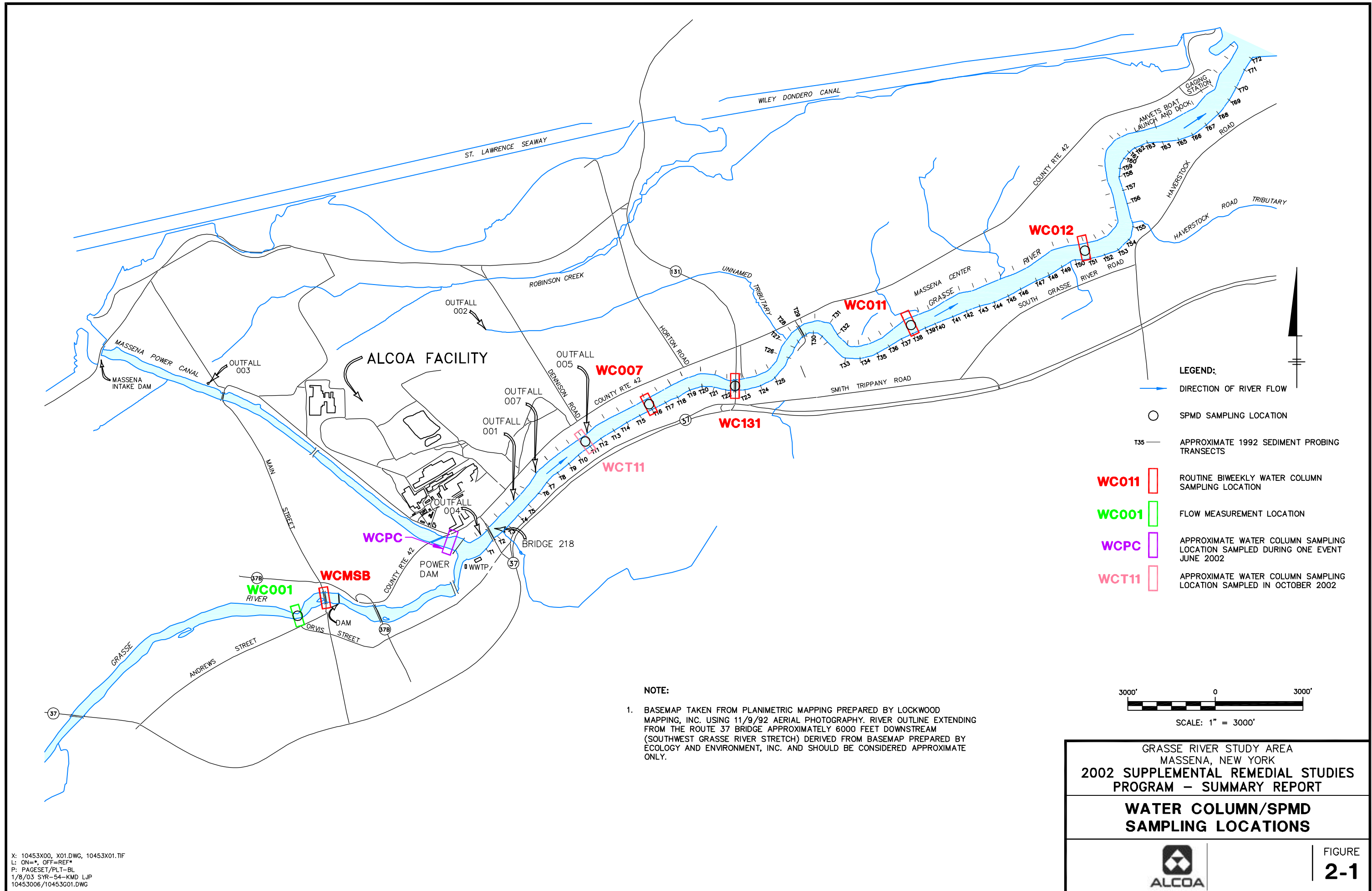
**Table 2-3
2002 Supplemental Remedial Studies - Summary Report
SPMD Data**

Subset of data table: spmd_bz

Set	Exposure Period	Transect	Fraction of Total Water Depth	Duplicate	Total Water Depth [ft]	Sample Depth [feet]	Total PCBs [ug]
4	8/12 - 8/28	SPMD-001	0.5		4.0	2.0	0.09
4	8/12 - 8/28	SPMD-007	0.2		15.0	3.0	17.84
4	8/12 - 8/28	SPMD-007	0.2	DUP	15.0	3.0	18.32
4	8/12 - 8/28	SPMD-007	0.8		15.0	12.0	26.00
4	8/12 - 8/28	SPMD-131	0.2		21.0	4.2	25.19
4	8/12 - 8/28	SPMD-131	0.8		21.0	16.8	18.80
4	8/12 - 8/28	SPMD-011	0.2		15.0	3.0	24.29
4	8/12 - 8/28	SPMD-011	0.8		15.0	12.0	25.22
4	8/12 - 8/28	SPMD-012	0.2		15.0	3.0	20.92
4	8/12 - 8/28	SPMD-012	0.8		15.0	12.0	23.91
5	9/11 - 9/24	SPMD-001	0.5		3.7	1.4	0.14
5	9/11 - 9/24	SPMD-007	0.2		16.0	3.2	14.64
5	9/11 - 9/24	SPMD-007	0.2	DUP	16.0	3.2	15.06
5	9/11 - 9/24	SPMD-007	0.8		16.0	12.8	17.30
5	9/11 - 9/24	SPMD-131	0.2		21.0	4.2	19.21
5	9/11 - 9/24	SPMD-131	0.8		21.0	16.8	23.81
5	9/11 - 9/24	SPMD-011	0.2		16.0	3.2	22.45
5	9/11 - 9/24	SPMD-011	0.8		16.0	12.8	25.84
5	9/11 - 9/24	SPMD-012	0.2		16.0	3.2	25.63
5	9/11 - 9/24	SPMD-012	0.8		16.0	12.8	32.66
6	10/8 - 10/21	SPMD-001	0.5		4.0	2.0	0.10
6	10/8 - 10/21	SPMD-T11	0.2		12.0	2.4	4.38
6	10/8 - 10/21	SPMD-T11	0.8		12.0	9.6	3.77
6	10/8 - 10/21	SPMD-007	0.2		15.0	3.0	6.11
6	10/8 - 10/21	SPMD-007	0.2	DUP	15.0	3.0	4.77
6	10/8 - 10/21	SPMD-007	0.8		15.0	12.0	6.15
6	10/8 - 10/21	SPMD-131	0.2		22.0	4.4	9.36
6	10/8 - 10/21	SPMD-131	0.8		22.0	17.6	8.75
6	10/8 - 10/21	SPMD-011	0.2		15.0	3.0	15.55
6	10/8 - 10/21	SPMD-011	0.8		15.0	12.0	14.04
6	10/8 - 10/21	SPMD-012	0.2		14.0	2.8	17.60
6	10/8 - 10/21	SPMD-012	0.8		14.0	11.2	17.56

Notes:

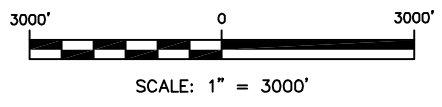
1. Damaged sample not submitted for PCB analysis.
2. If a sample is a duplicate sample, DUP is listed under Duplicate.



- LEGEND:**
- DIRECTION OF RIVER FLOW
 - SPMD SAMPLING LOCATION
 - APPROXIMATE 1992 SEDIMENT PROBING TRANSECTS
 - WC011** ROUTINE BIWEEKLY WATER COLUMN SAMPLING LOCATION
 - WC001** FLOW MEASUREMENT LOCATION
 - WCPC** APPROXIMATE WATER COLUMN SAMPLING LOCATION SAMPLED DURING ONE EVENT JUNE 2002
 - WCT11** APPROXIMATE WATER COLUMN SAMPLING LOCATION SAMPLED IN OCTOBER 2002

NOTE:

- BASEMAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. RIVER OUTLINE EXTENDING FROM THE ROUTE 37 BRIDGE APPROXIMATELY 6000 FEET DOWNSTREAM (SOUTHWEST GRASSE RIVER STRETCH) DERIVED FROM BASEMAP PREPARED BY ECOLOGY AND ENVIRONMENT, INC. AND SHOULD BE CONSIDERED APPROXIMATE ONLY.



GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
**2002 SUPPLEMENTAL REMEDIAL STUDIES
PROGRAM – SUMMARY REPORT**

**WATER COLUMN/SPMD
SAMPLING LOCATIONS**

FIGURE
2-1

X: 10453X00, X01.DWG, 10453X01.TIF
 L: ON=*, OFF=REF*
 P: PAGESET/PLT-BL
 1/8/03 SYR-54-KMD LJP
 10453006/10453G01.DWG

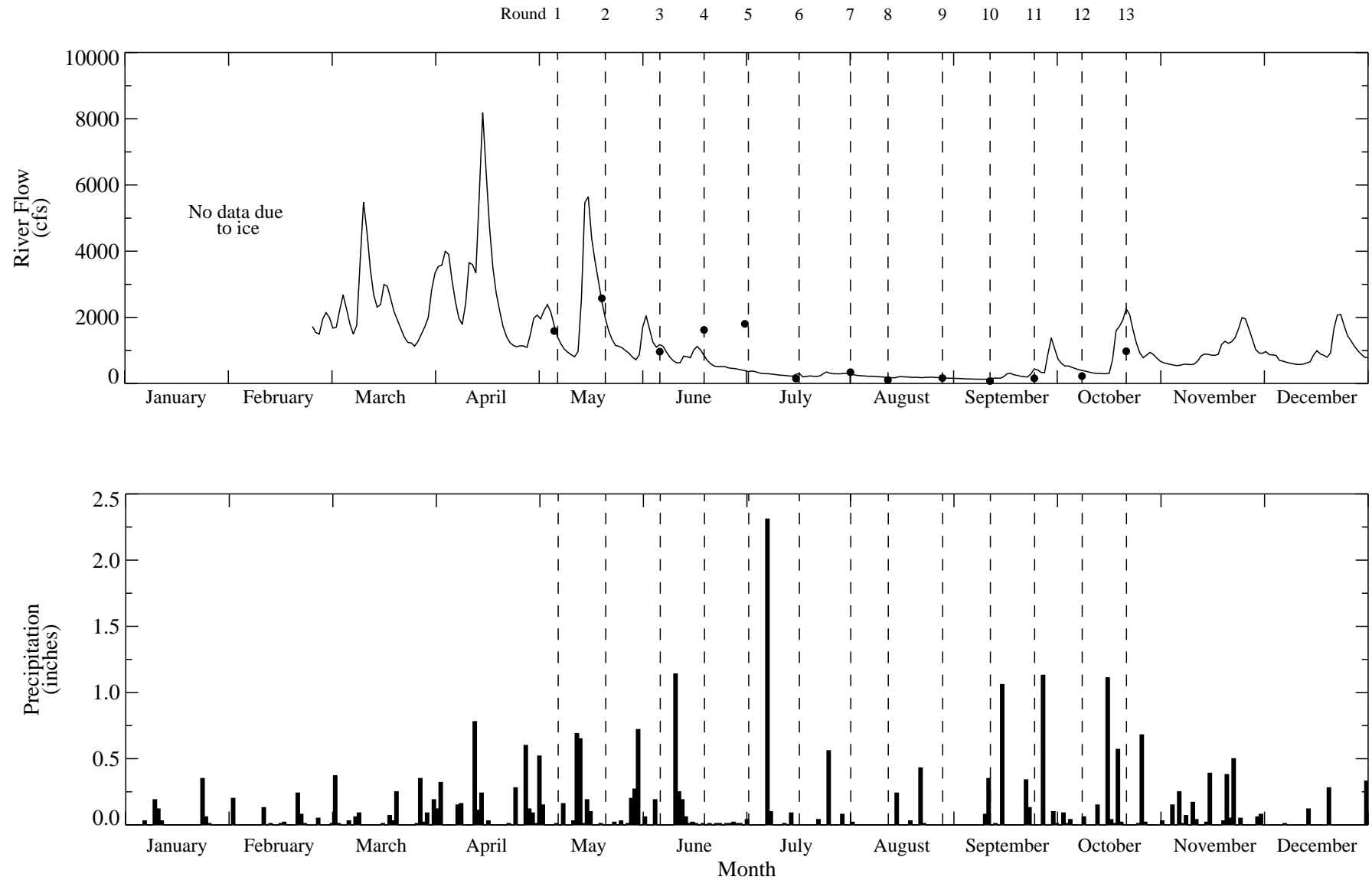


Figure 2-2. Flow and Precipitation Measurements from 2002

Grasse River flow (line) estimated from flow records of the Oswegatchie River at Harrisville (USGS).

Grasse River flow (symbols) measured at water sampling Transect WC001.

Grasse River precipitation measured near Outfall 007.

Data tables: climate, riverflow_hist, riverflow_tapedown, water_iupac

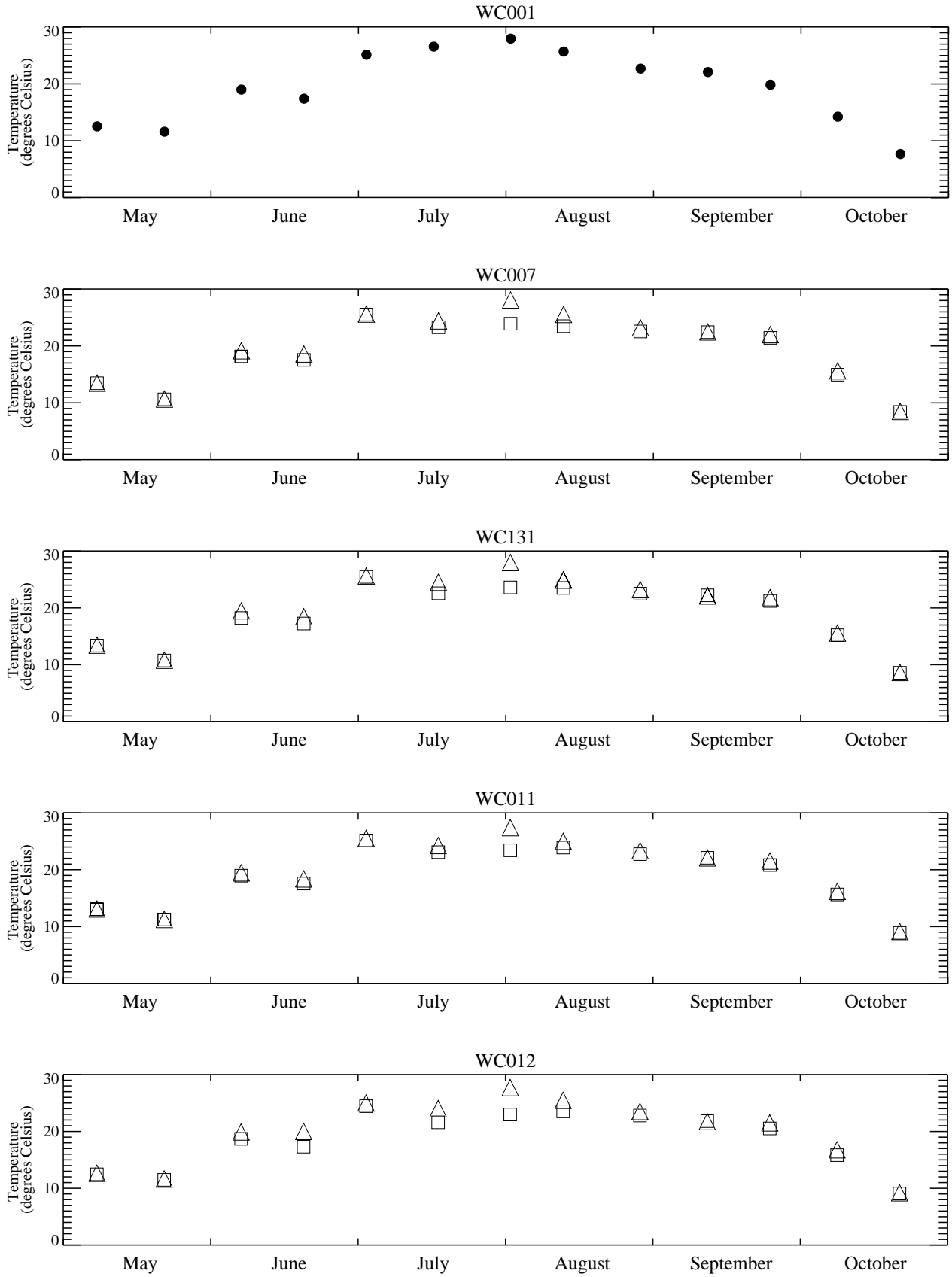
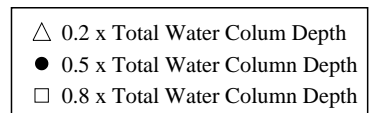


Figure 2-3. Temperature Measurements at WC001, WC007, WC131, WC011, and WC012

Grasse River Study Area - Supplemental Remedial Studies 2002

Data table: water_iupac



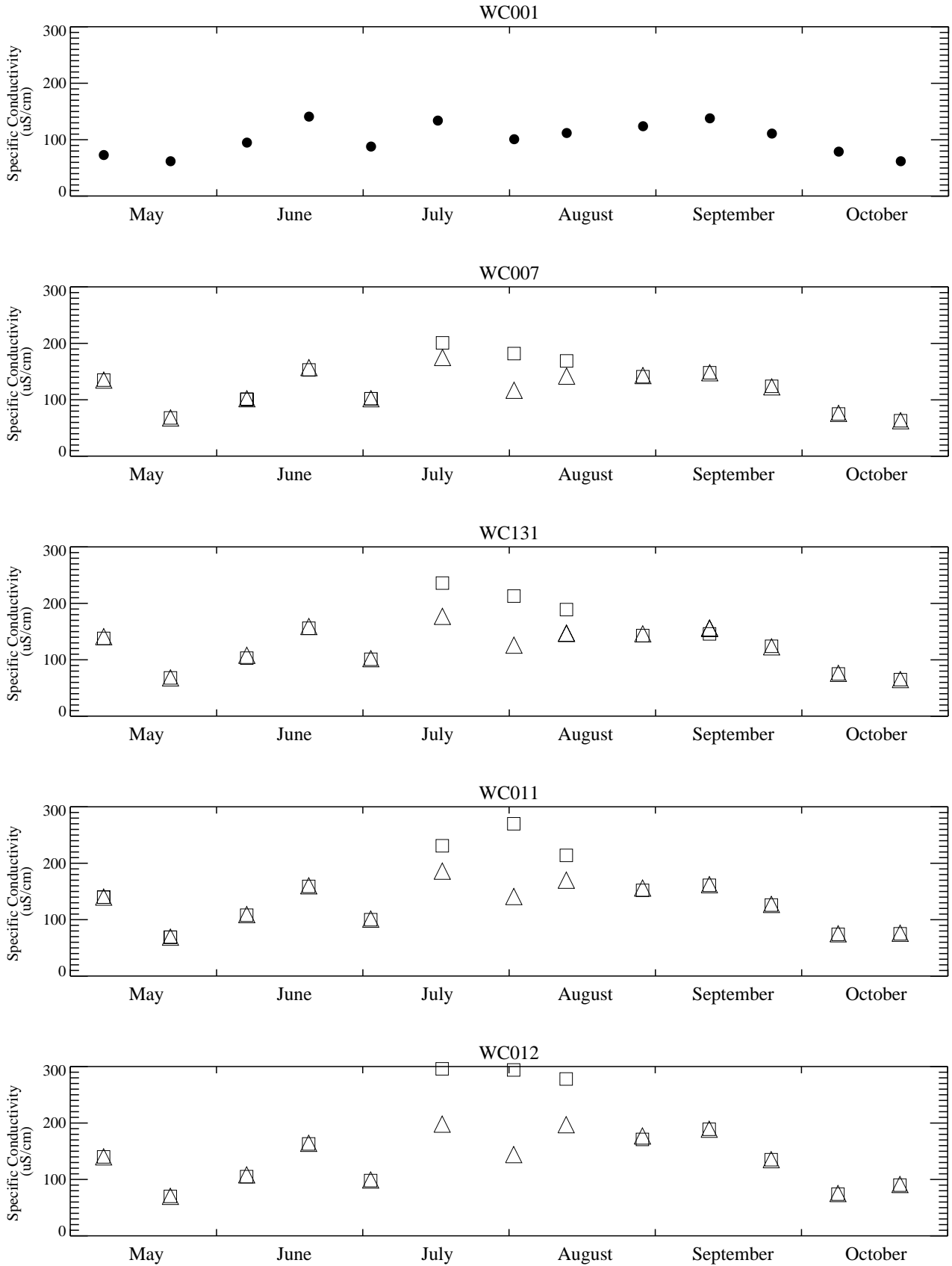
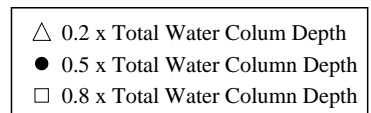


Figure 2-4. Specific Conductivity Measurements at WC001, WC007, WC131, WC011, and WC012

Grasse River Study Area - Supplemental Remedial Studies 2002

Data table: water_iupac



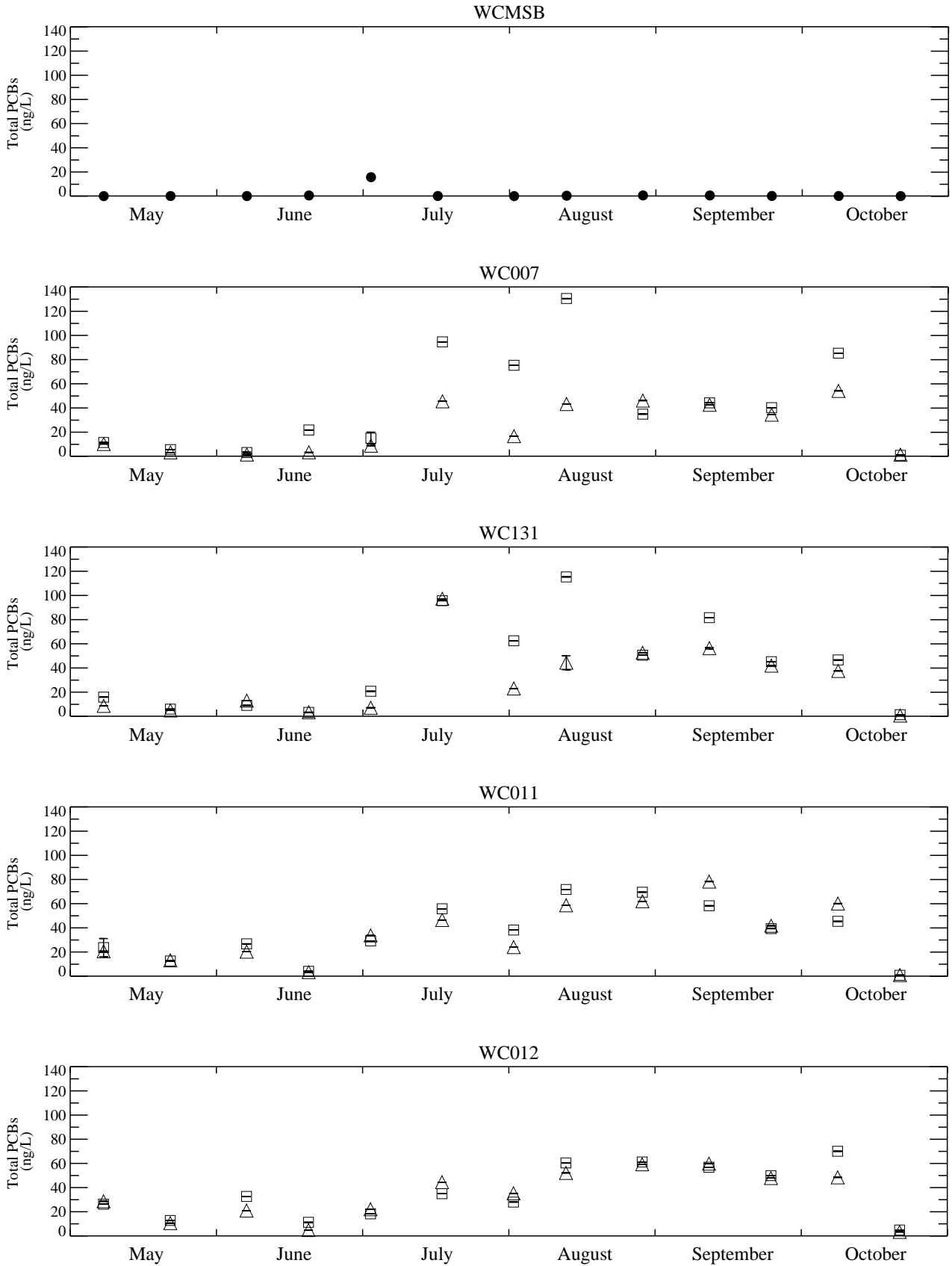
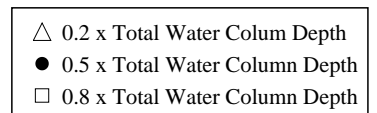


Figure 2-5. Measurements of Total PCBs at WCMSB, WC007, WC131, WC011, and WC012

Grasse River Study Area - Supplemental Remedial Studies 2002

Duplicates averaged with original sample (error bar represents range)

Data table: water_iupac



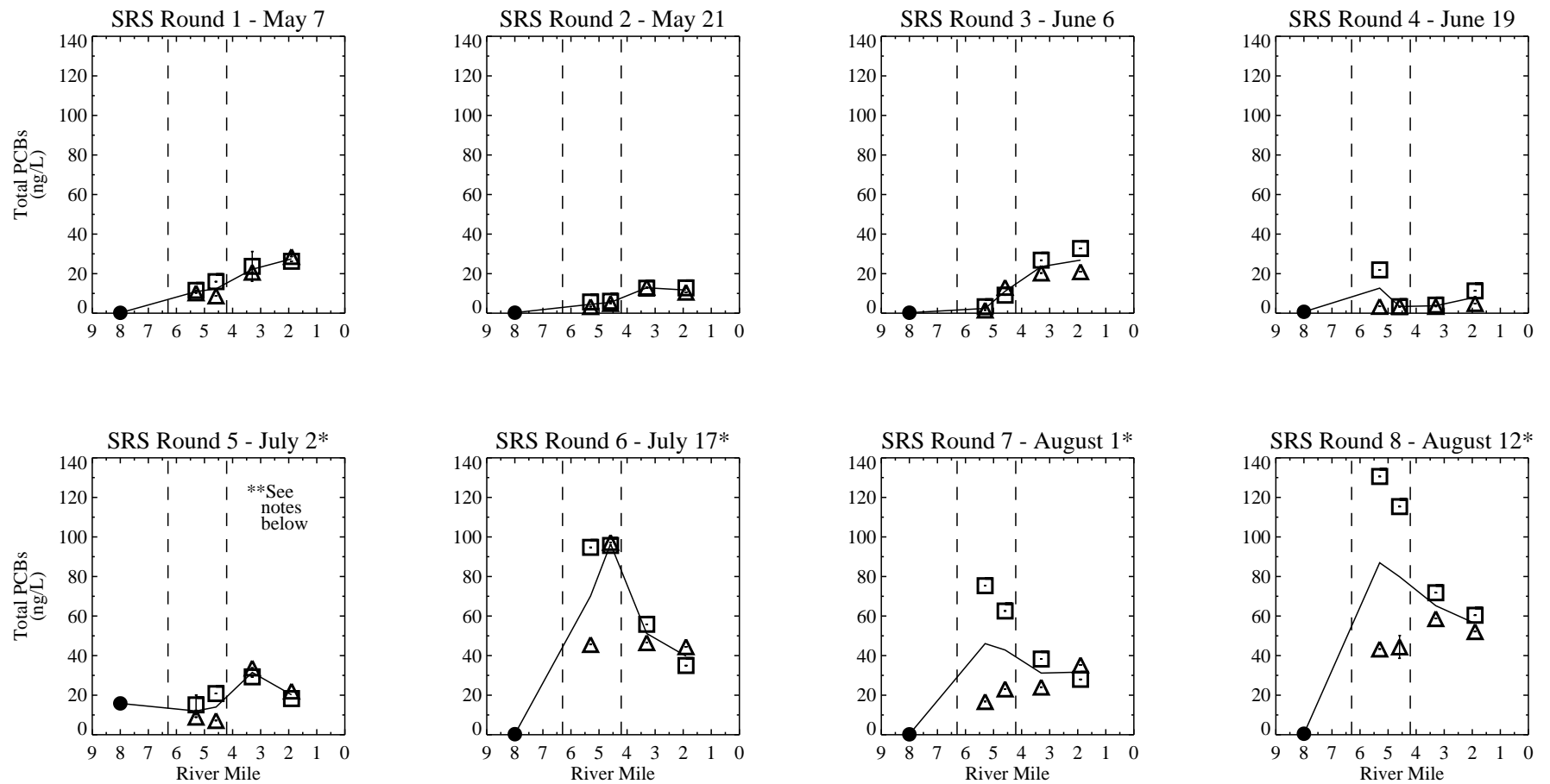


Figure 2-6. Spatial Distribution of Total PCBs in Water Samples Collected During the 2002 SRS Program

Values represent unfiltered water column sample results.

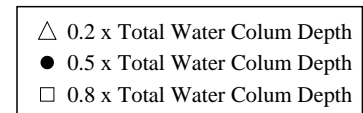
Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).

Duplicates averaged (error bar represents range).

*Data suggest the presence of stratification. The extent and magnitude of stratification vary by round and by year.

**Laboratory contamination may have occurred during this round, as a PCB concentration of 10.3 ng/L was reported for the laboratory blank.

Data table: water_iupac



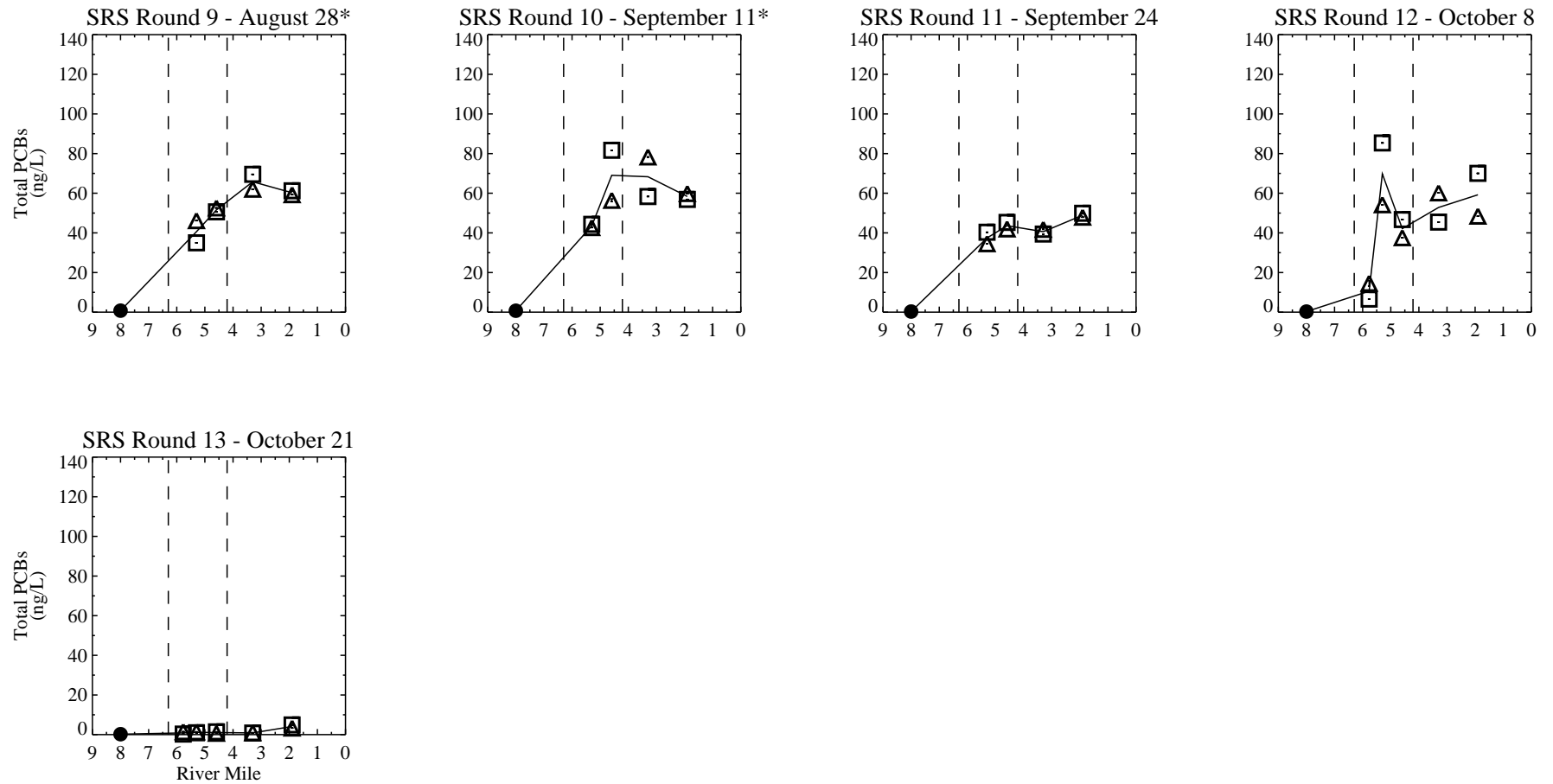


Figure 2-6. Spatial Distribution of Total PCBs in Water Samples Collected During the 2002 SRS Program

Values represent unfiltered water column sample results.

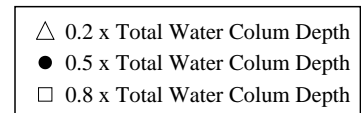
Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).

Duplicates averaged (error bar represents range).

*Data suggest the presence of stratification. The extent and magnitude of stratification vary by round and by year.

**Laboratory contamination may have occurred during this round, as a PCB concentration of 10.3 ng/L was reported for the laboratory blank.

Data table: water_iupac



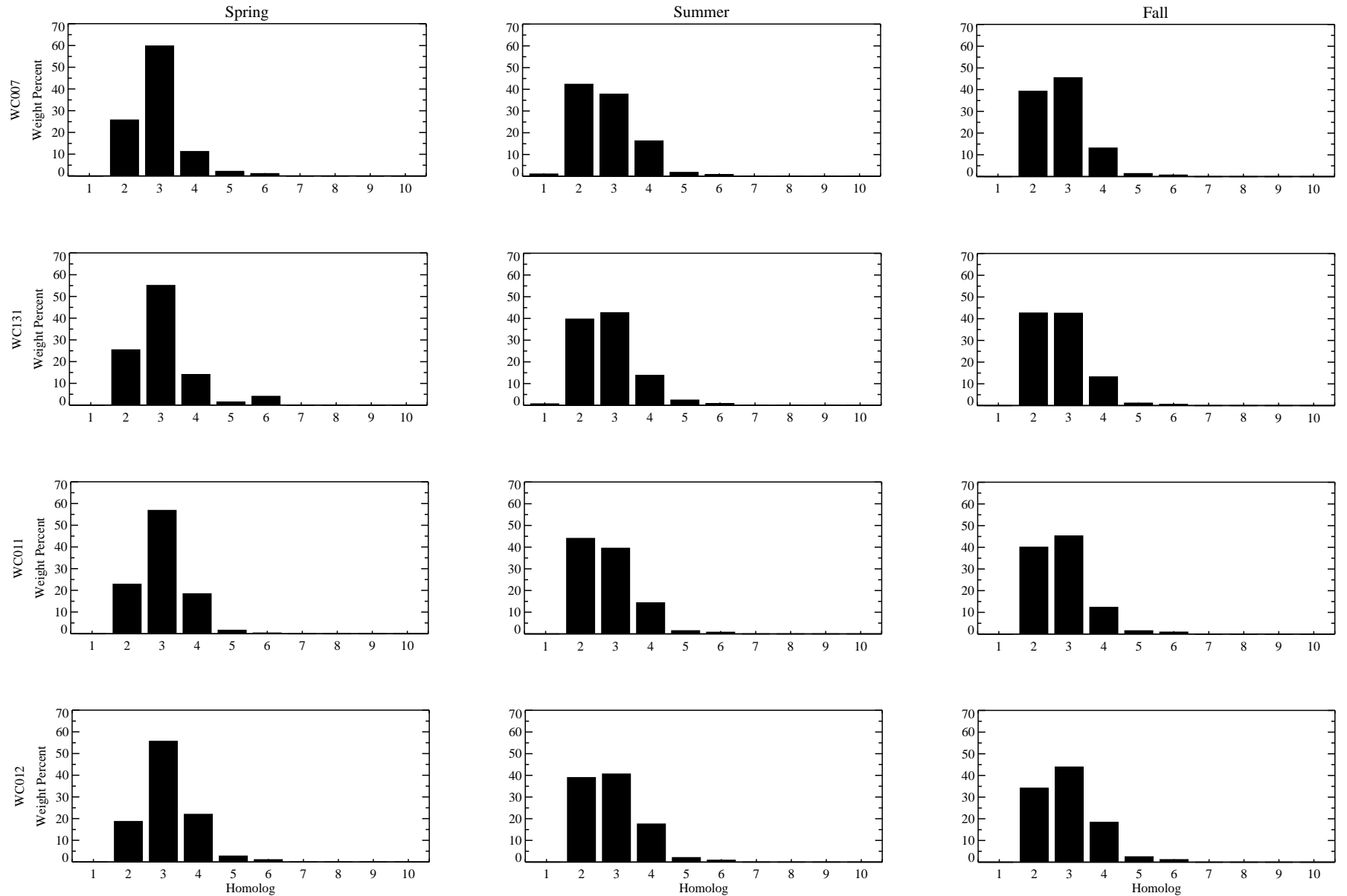


Figure 2-7. Average Homolog Distributions in Water Samples Collected in 2002

Grasse River Study Area - Supplemental Remedial Studies 2002

Spring - May & June; Summer - July & August; Fall - September & October

Bars represent average water column results at each location for each season

Data table: water_iupac

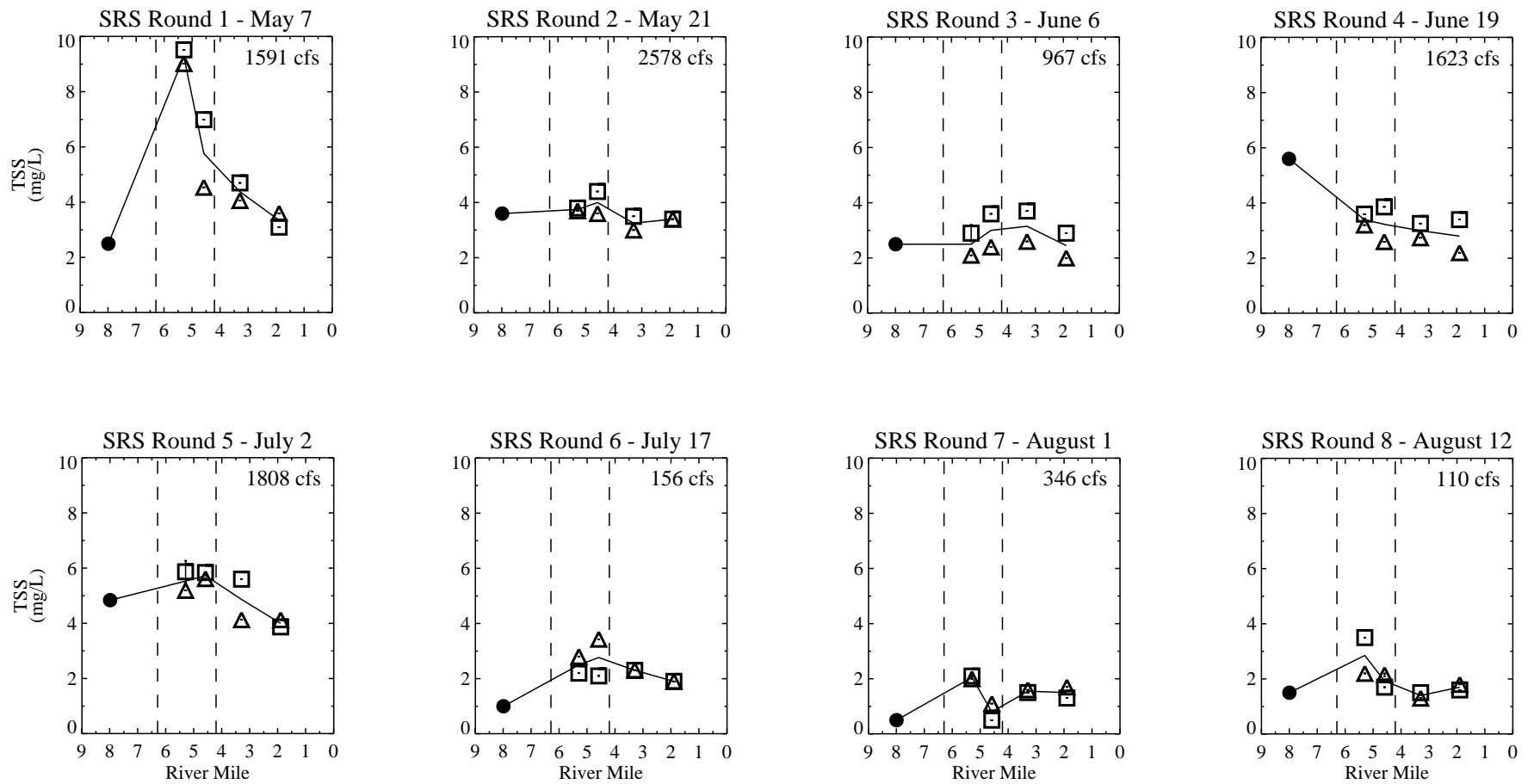


Figure 2-8. Spatial Distribution of TSS Concentrations Measured During the 2002 SRS Program

Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).

Estimated flows indicated in upper right corner. Values below the detection limit set to half the detection limit.

Flows measured at WC001 the same or previous day.

Duplicates averaged (error bar represents range).

Data tables: riverflow_tapedown, water_iupac

△ 0.2 x Total Water Colum Depth ● 0.5 x Total Water Colum Depth □ 0.8 x Total Water Colum Depth

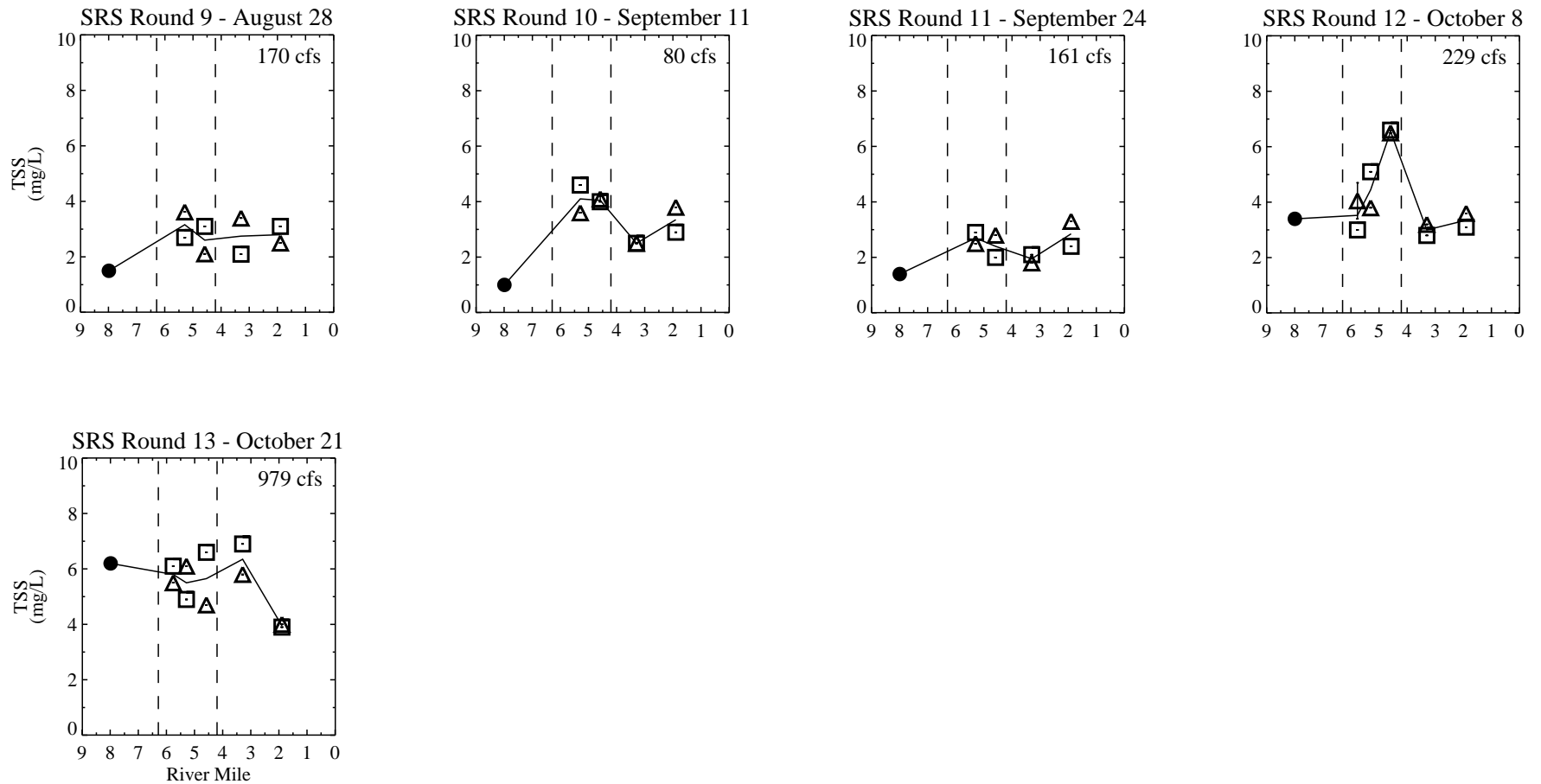


Figure 2-8. Spatial Distribution of TSS Concentrations Measured During the 2002 SRS Program

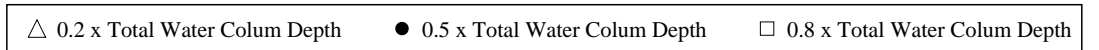
Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).

Estimated flows indicated in upper right corner. Values below the detection limit set to half the detection limit.

Flows measured at WC001 the same or previous day.

Duplicates averaged (error bar represents range).

Data tables: riverflow_tapedown, water_jupac



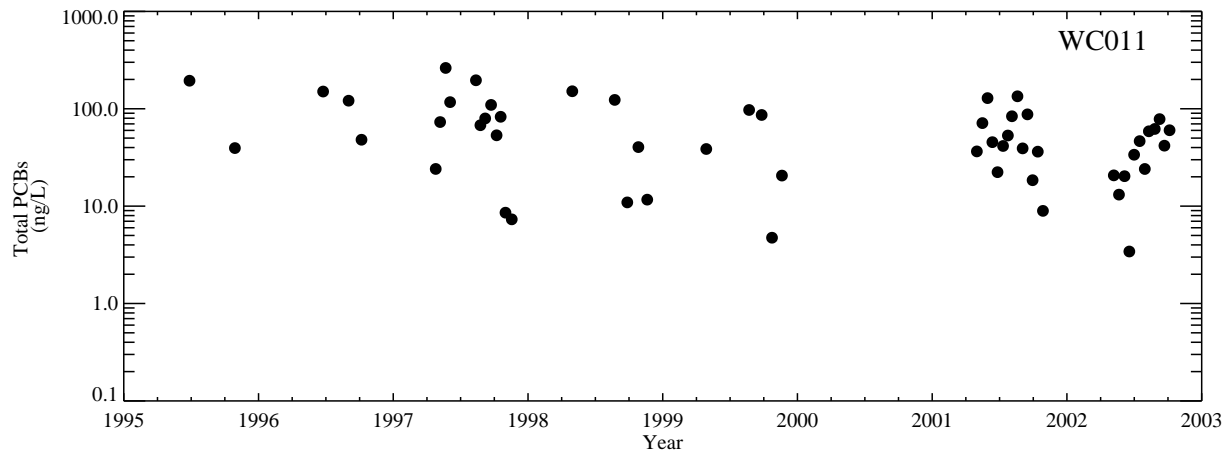
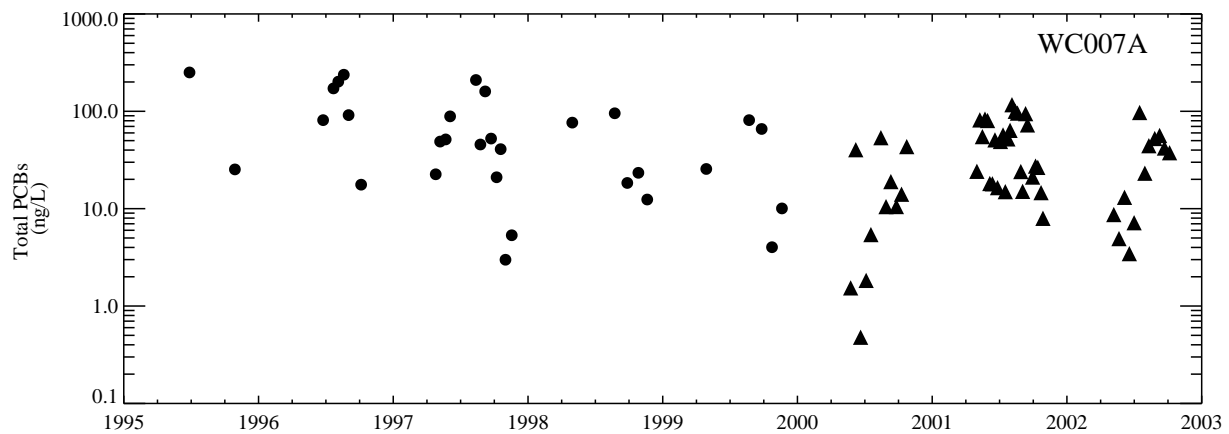
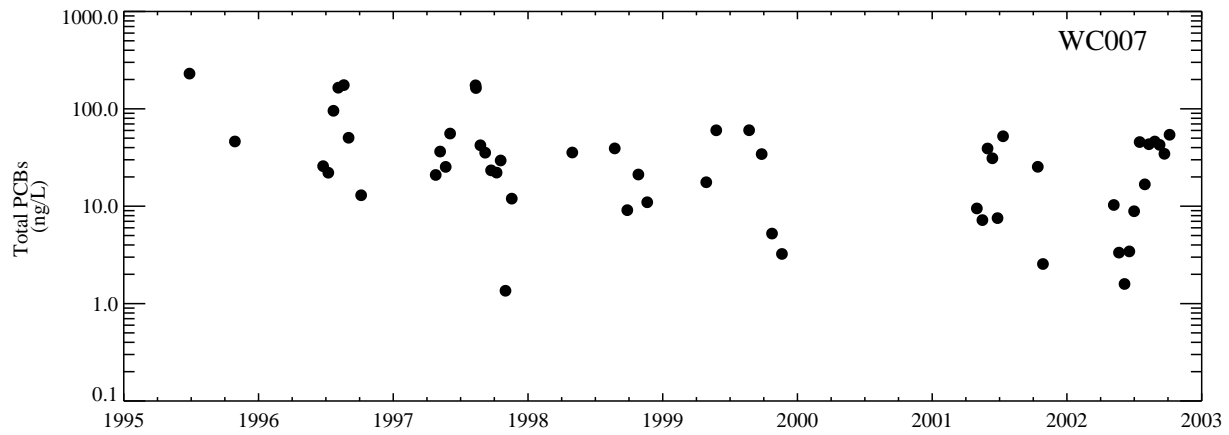


Figure 2-9. Water Column PCB Concentrations Measured During Non-Stratified Periods (1995-2002)

Triangles represent surface samples collected at WC131.

Data excluded due to elevated flows ($Q > 2000$ cfs).

Composite samples excluded due to stratification:

1996 Rounds 3, 4, and 5 (WC011 only) and 1997 Rounds 5, 6, and 7 (all locations).

Data from 2000 through 2002 represent surface samples collected at 0.2 x total water depth.

Duplicates averaged; data collected on same day averaged.

Data tables: riverflow_hist, water_bz, water_peak, water_iupac

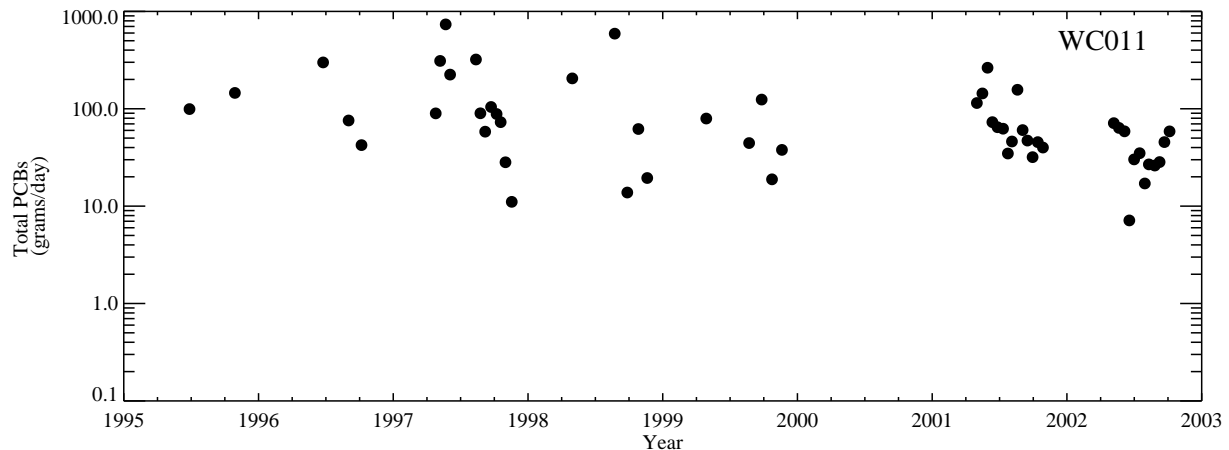
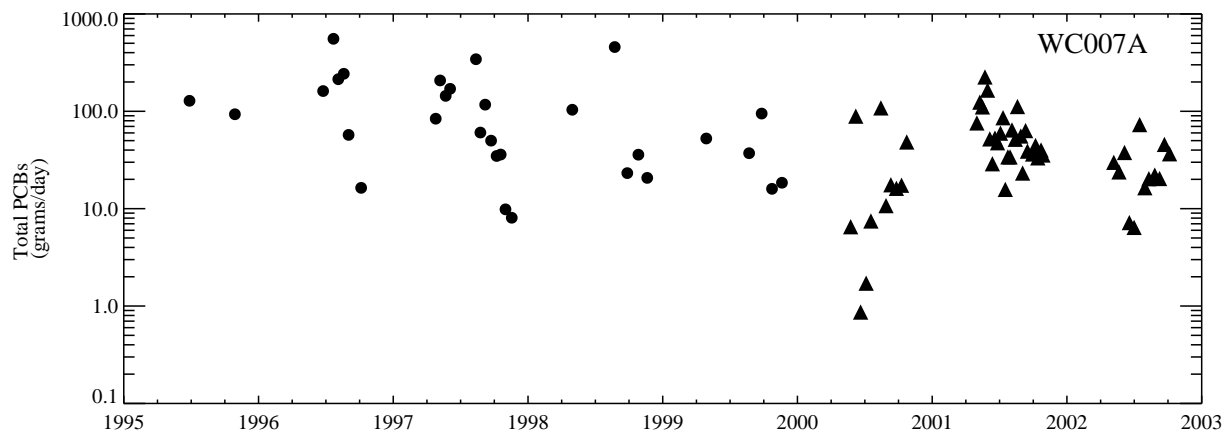
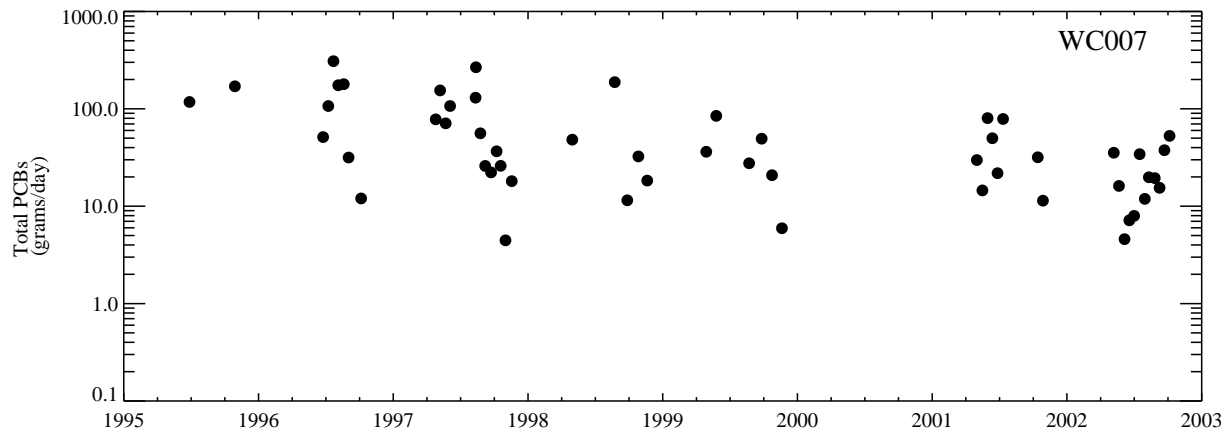


Figure 2-10. Water Column PCB Mass Fluxes During Non-Stratified Periods (1995-2002)

Triangles represent surface samples collected at WC131.

Data excluded due to elevated flows ($Q > 2000$ cfs).

Composite samples excluded due to stratification:

1996 Rounds 3, 4, and 5 (WC011 only) and 1997 Rounds 5, 6, and 7 (all locations).

Data from 2000 through 2002 represent surface samples collected at 0.2 x total water depth.

Duplicates averaged; data collected on same day averaged.

Data tables: riverflow_hist, water_bz, water_peak, water_iupac

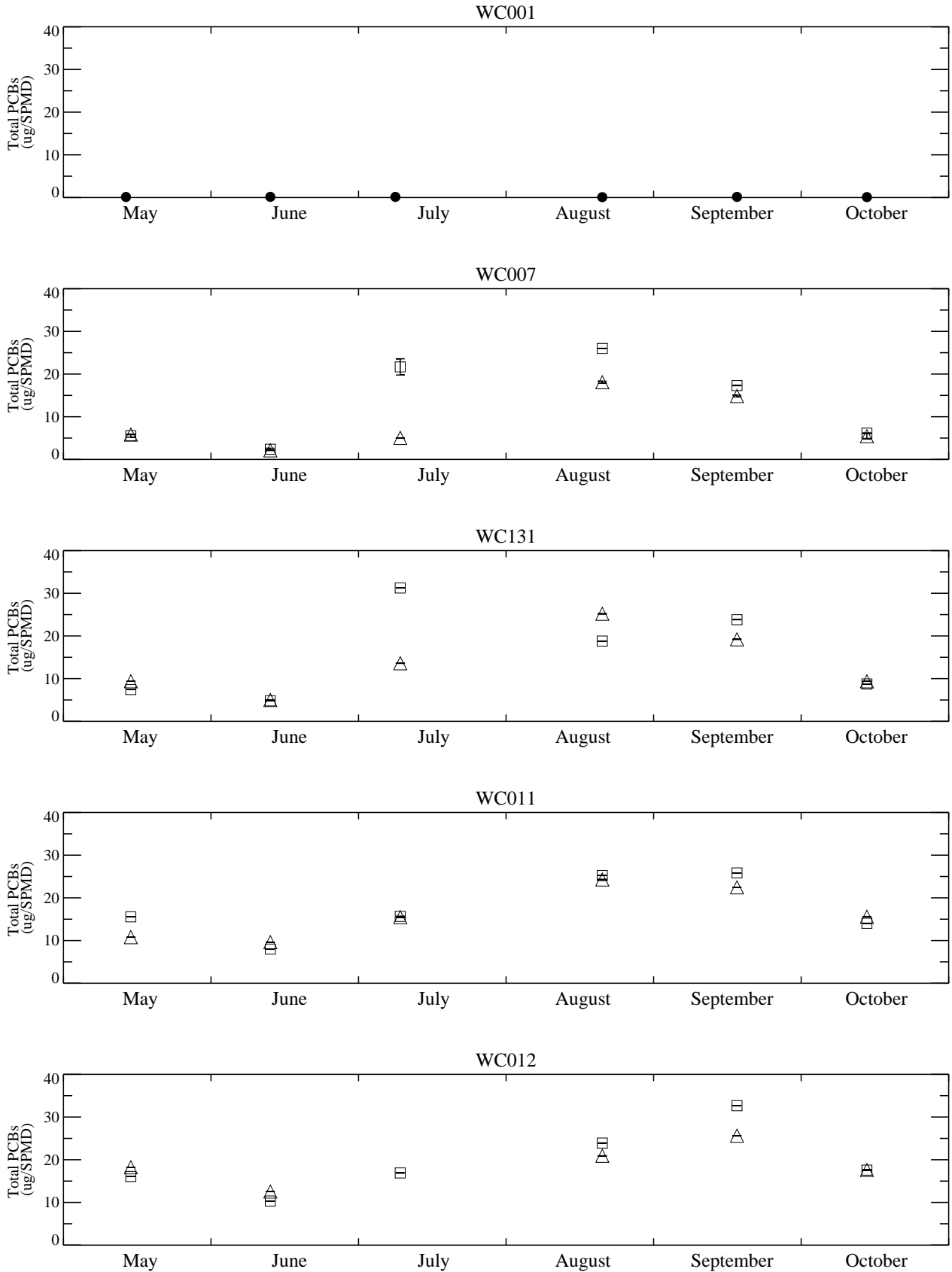


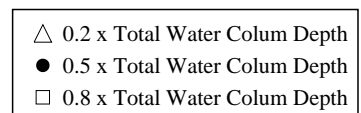
Figure 2-11. Total PCBs in SPMDs at WC001, WC007, WC131, WC011, and WC012

Grasse River Study Area - Supplemental Remedial Studies 2002

Data plotted at mid-date of sampling duration

Duplicates averaged (error bar represents range)

Data table: spmd_bz



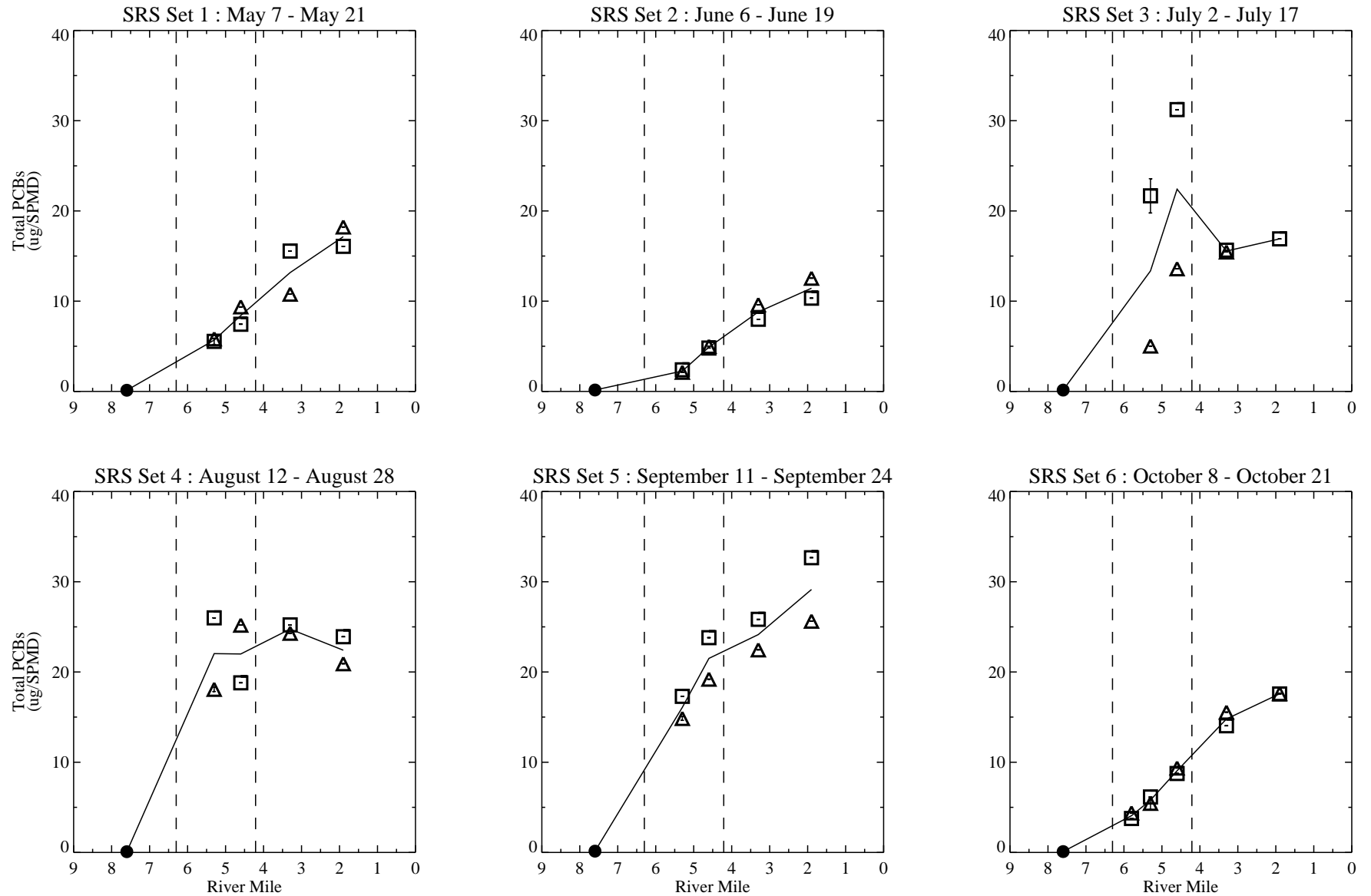


Figure 2-12. Spatial Distribution of Total PCBs in SPMD Samples Collected During the 2002 SRS Program

Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).

Duplicates averaged (error bar represents range).

Data table: **spmd_bz**

△ 0.2 x Total Water Colum Depth ● 0.5 x Total Water Colum Depth □ 0.8 x Total Water Colum Depth

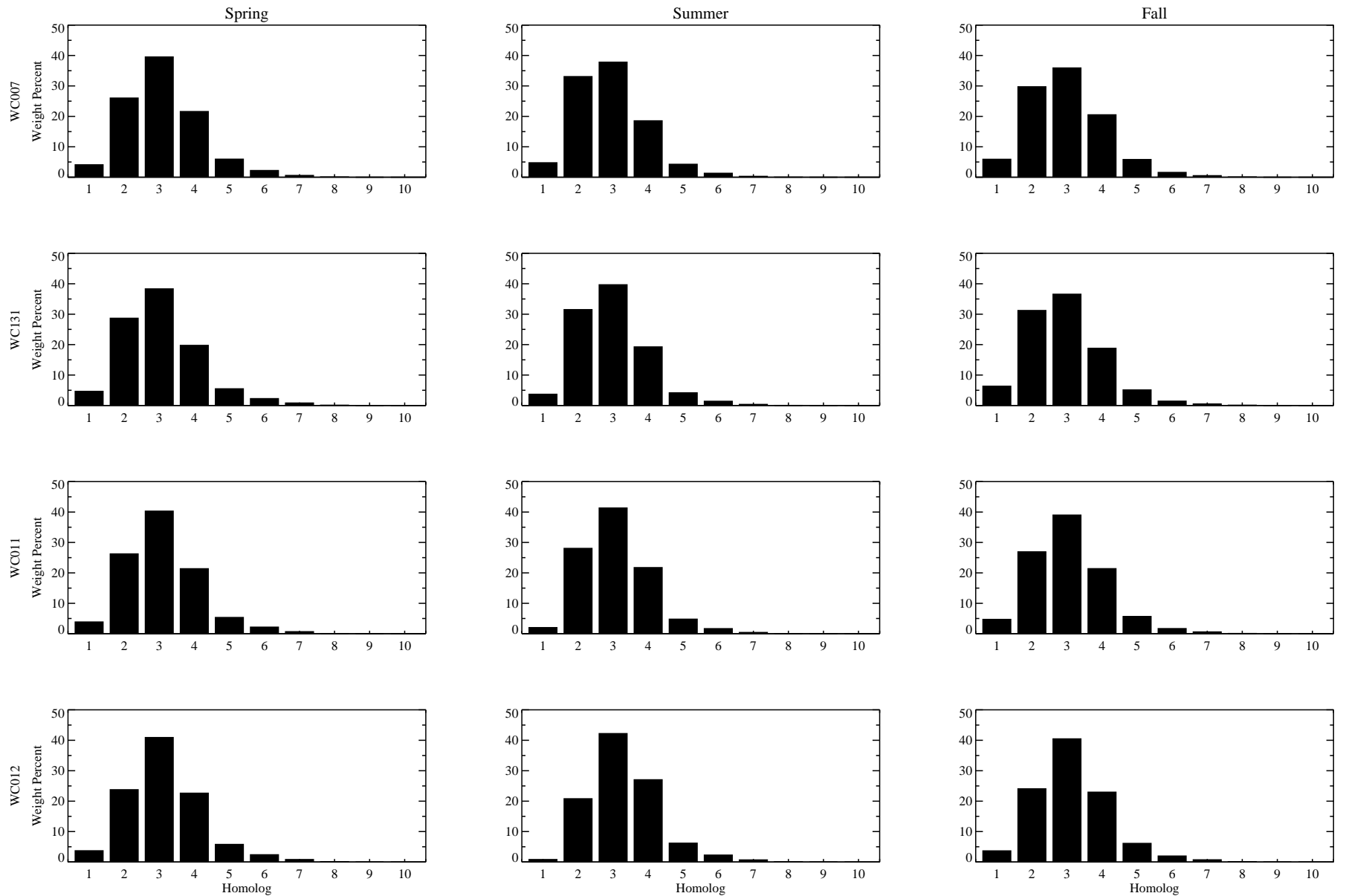


Figure 2-13. Average Homolog Distributions in SPMD Samples Collected in 2002

Grasse River Study Area - Supplemental Remedial Studies

Spring - May & June; Summer - July & August; Fall - September & October

Bars represent average water column results at each location for each season

Data table: spmd_bz