south river SCIENCE TEAM

Update: Ecological Study of the South River and a Segment of the South Fork Shenandoah River

URS

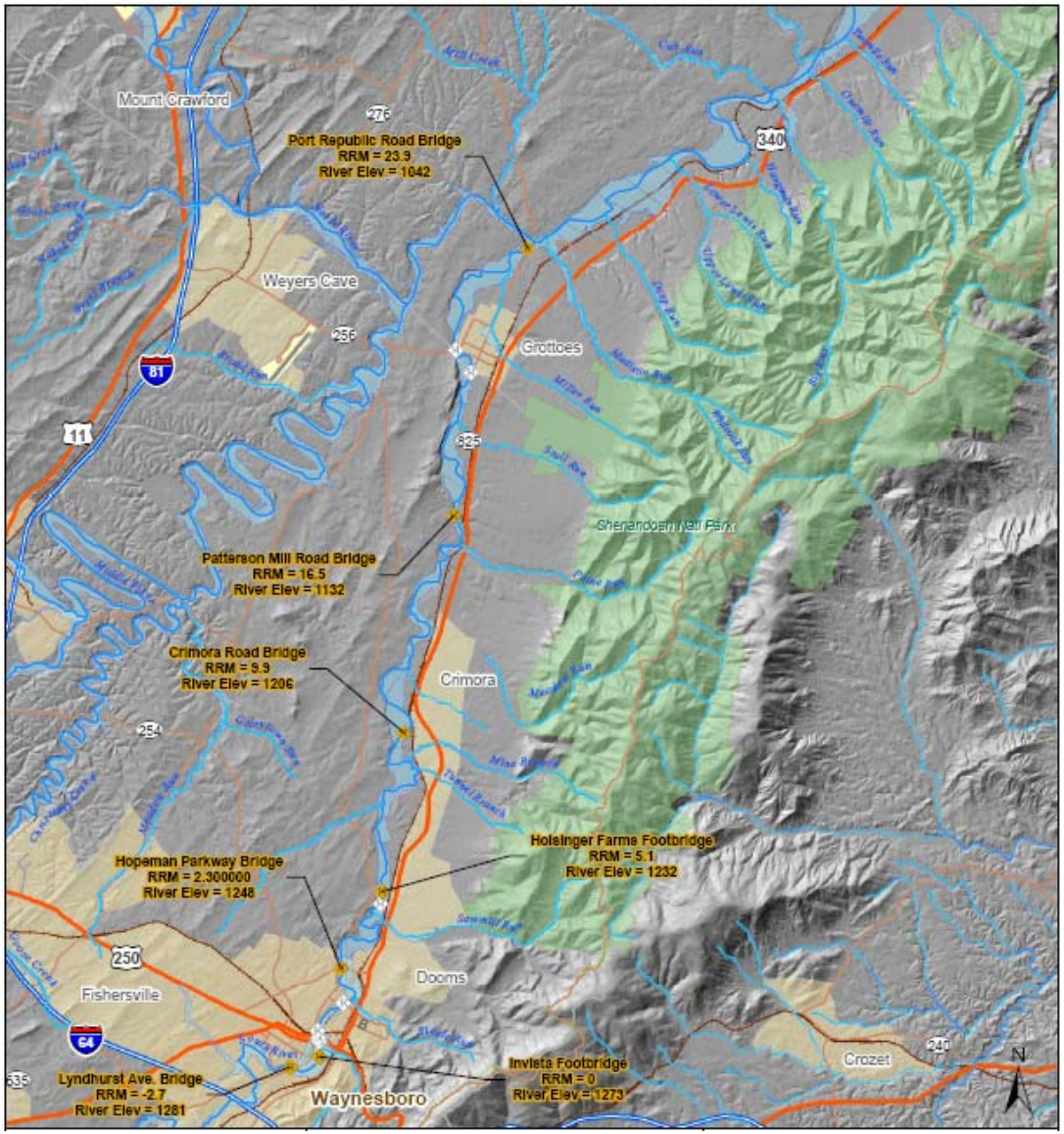
Presentation Outline –Phase I Ecological Study Progress

- Storm event sampling
- Monthly Baseline Sampling
  - March and April data

Phase I - Storm Event Sampling

Sampling Goals:

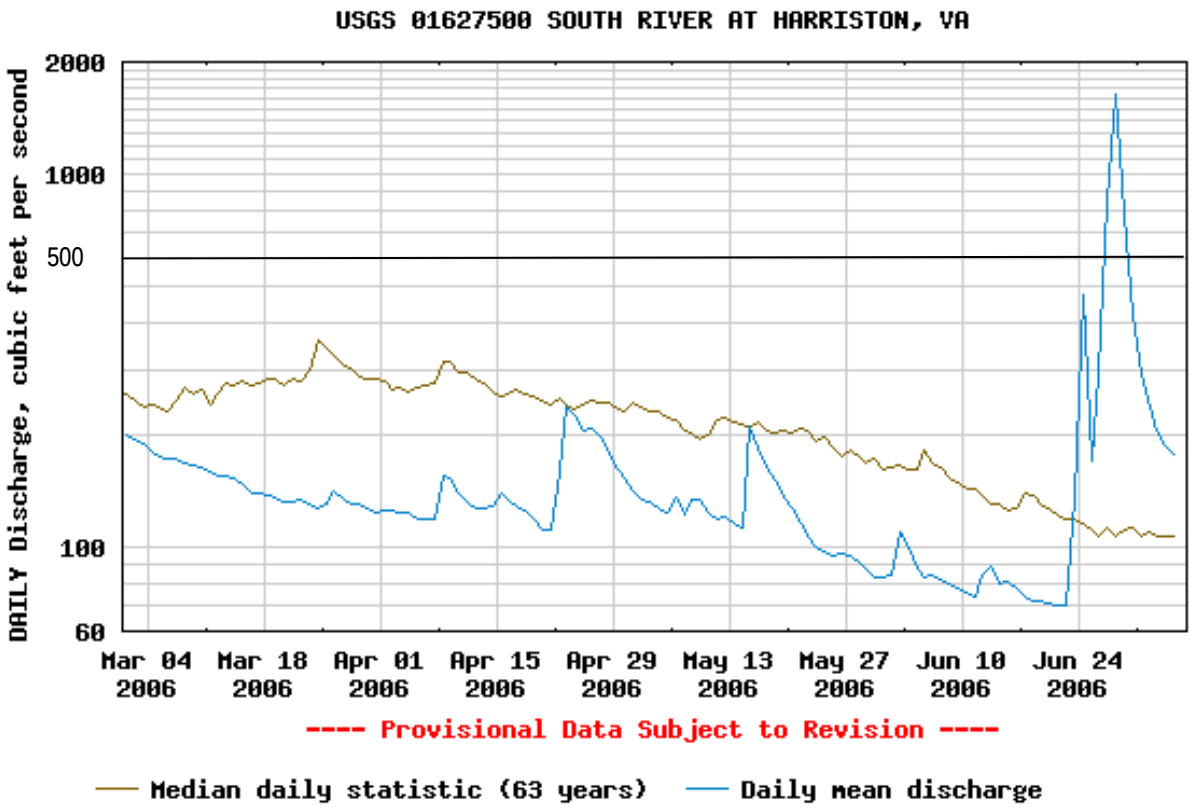
- One storm event of > 500-cfs flow each season at 7 bridge locations
- Collection of discrete surface water samples over various intervals on the hydrograph
  - baseline conditions
  - 3-hr intervals during rising discharge
  - 1, 3, 5, and 7-days during falling discharge



Phase I - Storm Event Sampling

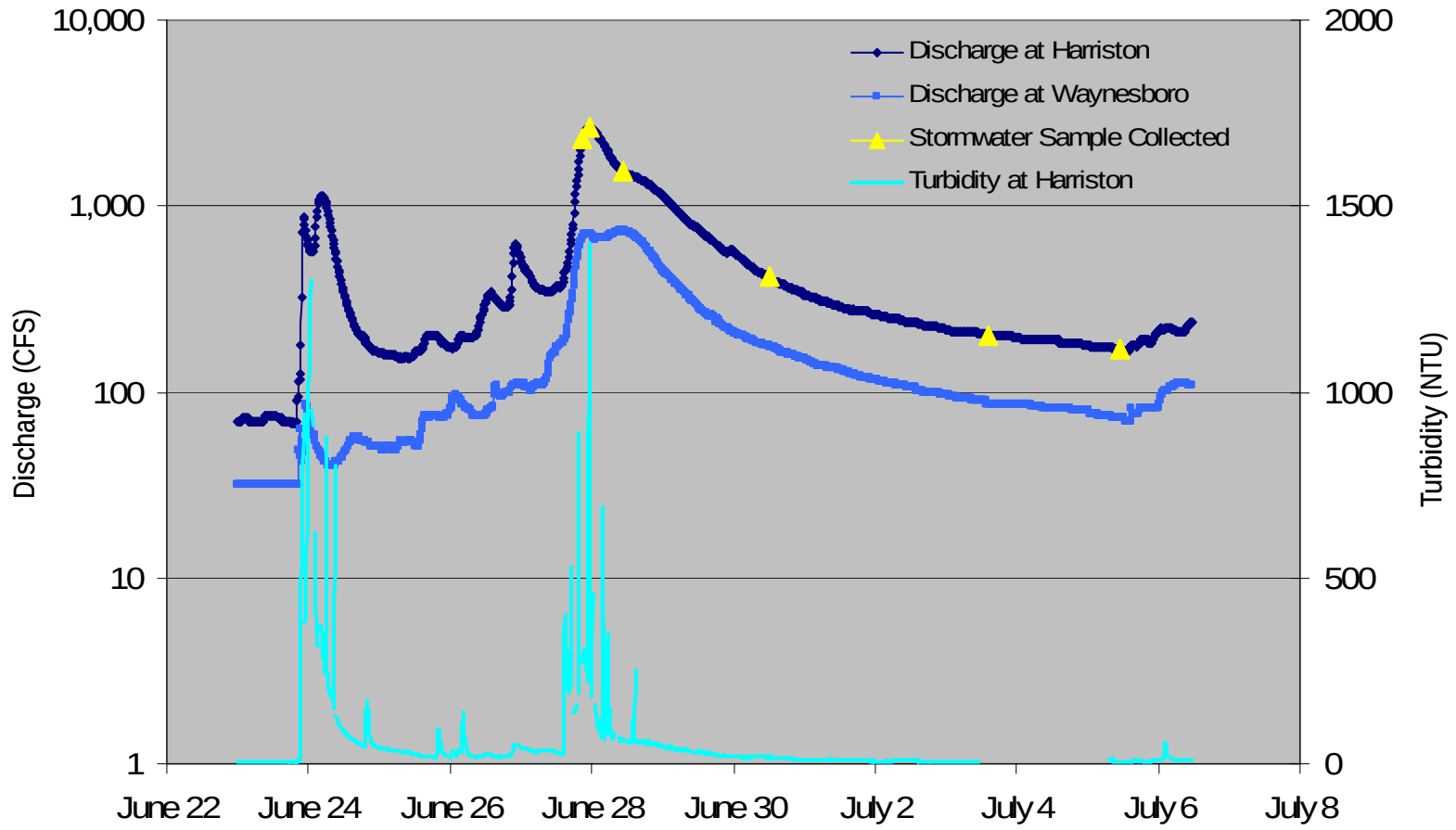
Progress Update:

- One storm event exceeded 500 CFS threshold at Harriston bridge gauge station
- Program will use manual collection; equipment limitations for automated samplers



Phase I - Storm Event Sampling, June 28

South River Real Time Discharge and Turbidity During Storm Event Sampling



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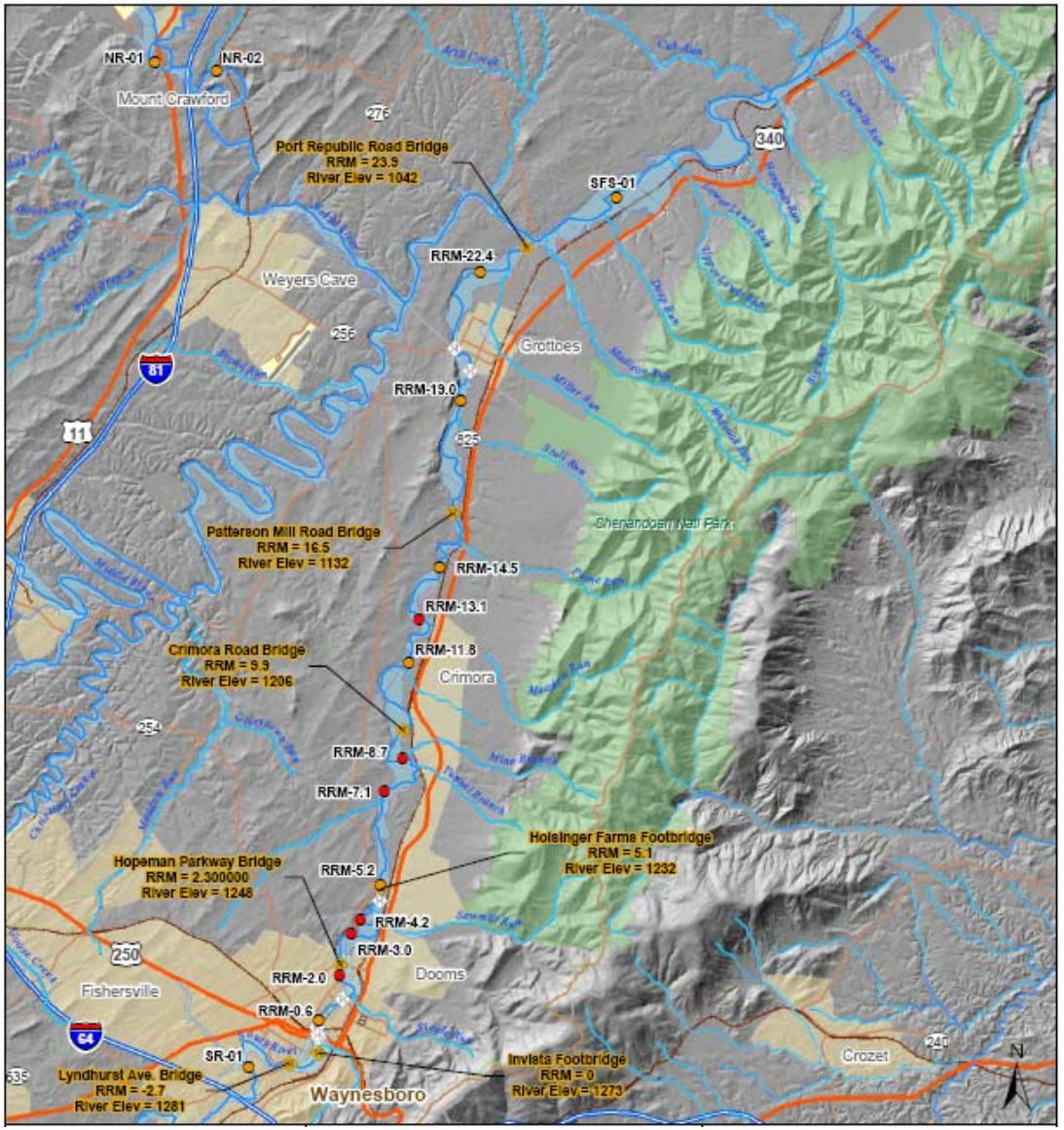
Phase I - Physical and Biological Assessment

Sampling Goals:

- 13 baseline stations in study area; 3 reference stations
- Monthly collections of surface water, sediment, and crayfish tissue
- Quarterly collections of other biological tissue
- Quarterly assessments of biological communities (fish biannually)



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Phase I - Physical and Biological Assessment

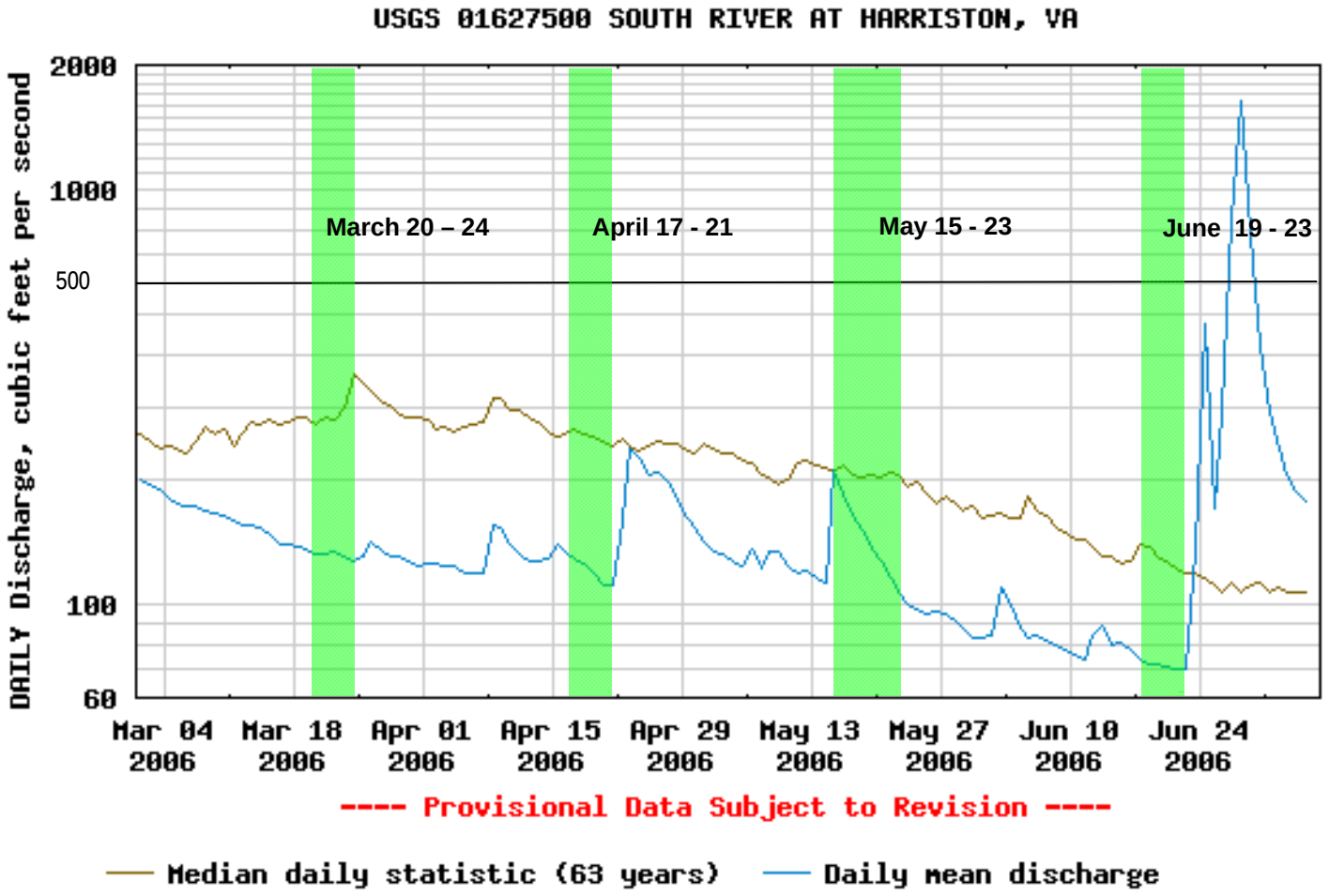
Progress Update:

- All sample parameters successfully collected at most locations
  - Physical habitat constraints at RRM-3.0 & 4.2
- March, April, June 2006: monthly collections of surface water, sediment, and crayfish tissue
- May 2006:
  - Surface water and sediment
  - Increased crayfish replication (n = 3)
  - Additional biological tissue samples
  - Community assessments at selected locations

Matrix/Type	March	April	May	June
Physical Media				
Surface Water	✔	✔	✔	✔
Sediment	✔	✔	✔	✔
Biological Tissue				
Filamentous algae			✔	
Crayfish	✔	✔	✔	✔
Corbicula			✔	
Diptera			✔	
Ephemeroptera			✔	
Trichoptera			✔	
Centrarchidae (Sunfish spp.)			✔	
Cyprinidae (Minnows)			✔	
Percidae (Darters)			✔	
Community Assessments				
Aquatic Invertebrates			✔	
Fish			✔	

Phase I - Physical and Biological Assessment

South River Daily Mean Discharge During Sampling



Surface Water Temperature

- Surface water temperature increased between March and April
- Similar increase between May and June
- These trends will help illustrate seasonal patterns, if any exist

Location	Surface Water Temperature (°C)			
	March	April	May	June
SR-01	9.7	14	16.9	22.2
RRM-0.6	9	15	17.7	24.6
RRM-2.0	9	15.3	16.5	24.1
RRM-3.0	8.8	18.8	17.3	20.4
RRM-4.2	7.3	16.4	17	20.8
RRM-5.2	8	13.1	14.2	21.2
RRM-7.1	7.9	12.2	14.6	21.4
RRM-8.7	7.8	13.4	14.7	22.8
RRM-11.8	9.6	15.4	16.8	23.5
RRM-13.1	7.5	15	17.4	21.4
RRM-14.6	8.7	13.4	17.4	22.3
RRM-19.0	7.9	13.1	17.6	23.6
RRM-22.4	7.4	14.2	15.3	22.4
SFS-01	8.6	14.5	15.9	25
NR-01	7.4	12	--	22.1
NR-02	9.1	13.5	--	24.4

Ancillary Parameters in Surface Water

Sample	Hardness (mg/L as $CaCO_3$)		Sulfate (mg/L)		Total NO_3/NO_2 (mg/L)		Total P as PO_4 (mg/L)		Total Organic Carbon (mg/L)	
	March	April	March	April	March	April	March	April	March	April
SR-01	96	--	9.4	8.8	0.8	0.6	<0.25	<0.25	--	2.0
RRM-0.6	114	95	9.1	8.0	0.9	0.8	<0.25	<0.25	1.4	1.9
RRM-2.0	102	89	9.1	8.0	1.4	1.4	<0.25	0.4	2.0	2.5
RRM-3.0	115	--	9.4	8.8	1.3	1.5	<0.25	0.4	1.7	2.6
RRM-4.2	110	--	9.4	7.6	1.3	1.2	<0.25	<0.25	1.4	2.1
RRM-5.2	108	--	9.0	7.6	1.2	1.2	<0.25	<0.25	1.4	2.4
RRM-7.1	106	--	8.8	7.9	1.3	1.2	<0.25	<0.25	1.6	2.2
RRM-8.7	108	--	8.9	8.3	1.3	1.5	<0.25	<0.25	1.7	2.2
RRM-11.8	108	89	9.3	7.7	1.0	1.3	<0.25	<0.25	1.8	2.5
RRM-13.1	107	100	9.2	49	1.2	1.4	<0.25	<0.25	1.9	2.4
RRM-14.6	108	99	9.4	7.6	1.2	1.2	<0.25	<0.25	2.0	2.5
RRM-19.0	109	100	11.2	7.8	1.1	1.1	<0.25	<0.25	1.8	2.4
RRM-22.4	113	89	8.8	7.7	1.1	1.3	<0.25	<0.25	1.8	2.4
SFS-01	158	--	13.1	8.0	1.9	1.0	<0.25	<0.25	2.0	2.2
NR-01	117	42	9.7	6.7	2.1	0.8	<0.25	<0.25	1.7	1.6
NR-02	130	53	14.6	8.6	2.8	1.1	<0.25	<0.25	2.0	2.1

Note:

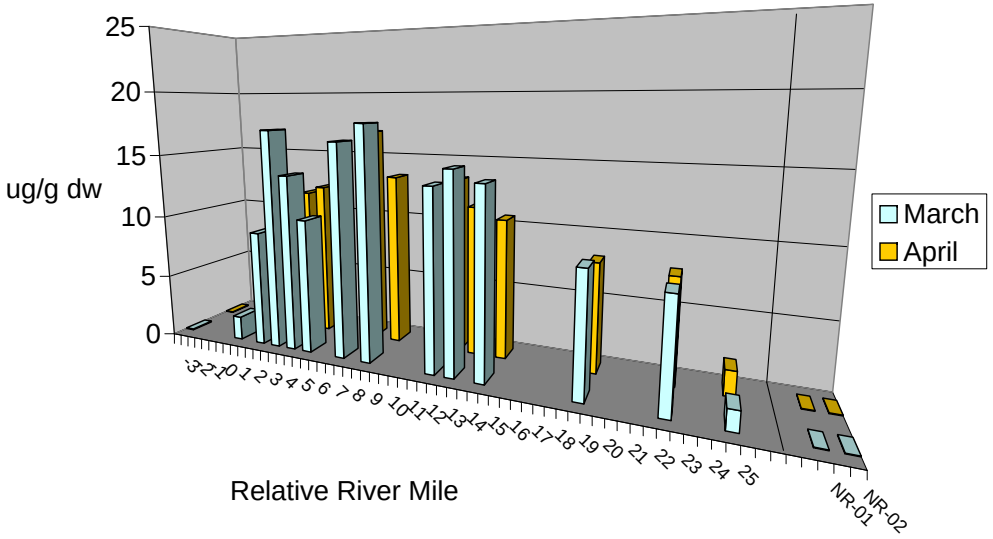
--: Not collected

[1] Hardness collected at areas sampled for metals.

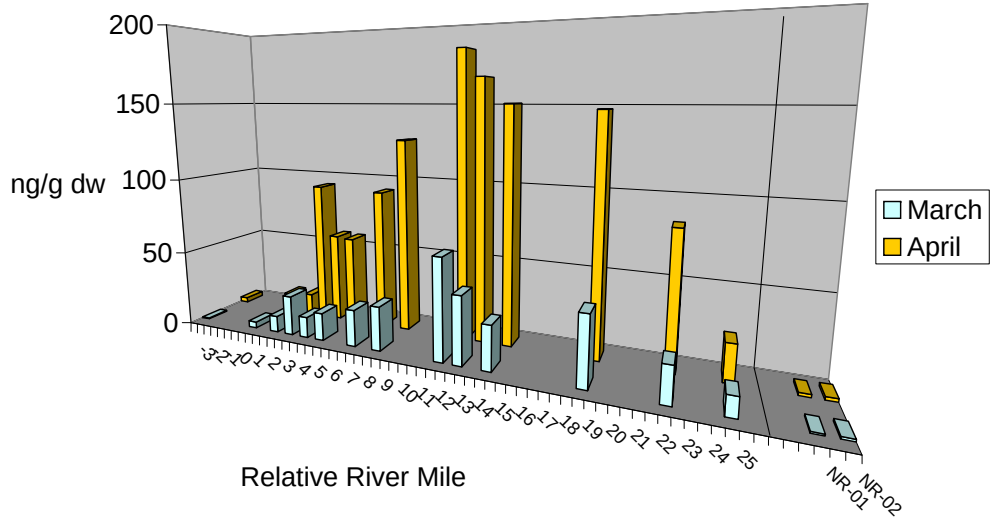
Total Mercury (THg) and Methylmercury (MeHg) in Sediment

- THg concentrations generally increase to ~RRM 8 and slowly decrease
- MeHg concentrations increase to ~RRM 12, (Forestry Station) and slowly decrease
- MeHg concentrations increase in April relative to March

Total Mercury in Sediment



Methylmercury in Sediment



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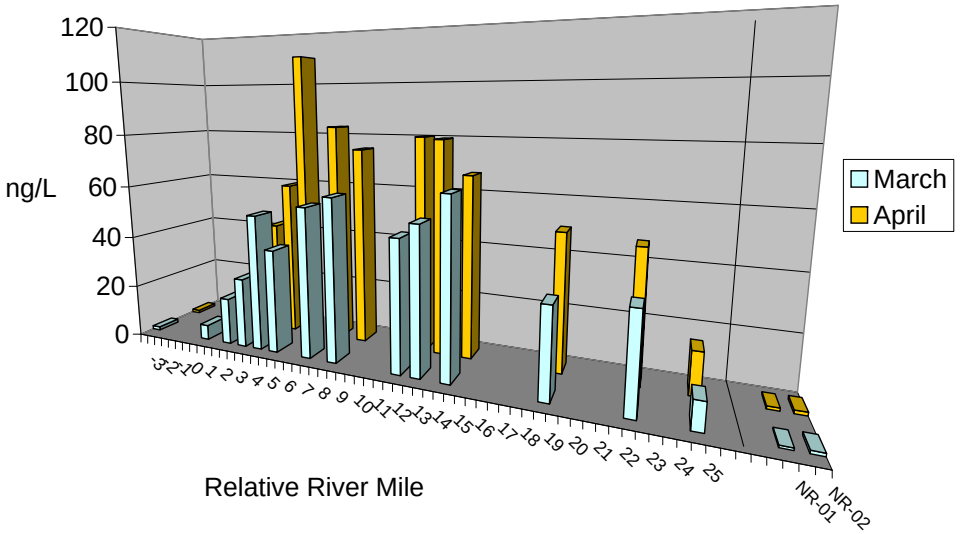
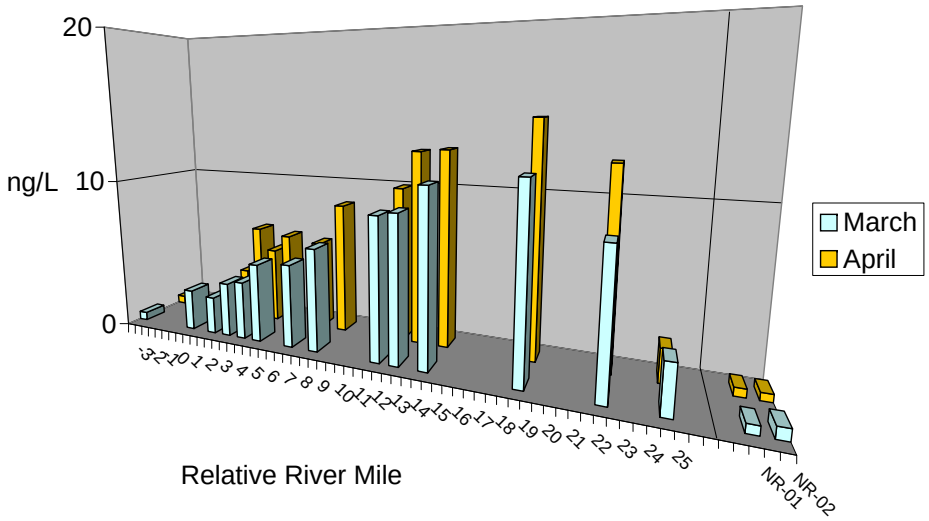
Total Mercury (THg) in Surface Water

- THg in unfiltered samples generally increases at ~RRM 5 and decreases thereafter
- THg in filtered surface water generally increases with distance along the South River
- THg concentrations in surface water are generally similar between these months

Unfiltered Total Mercury in Surface Water



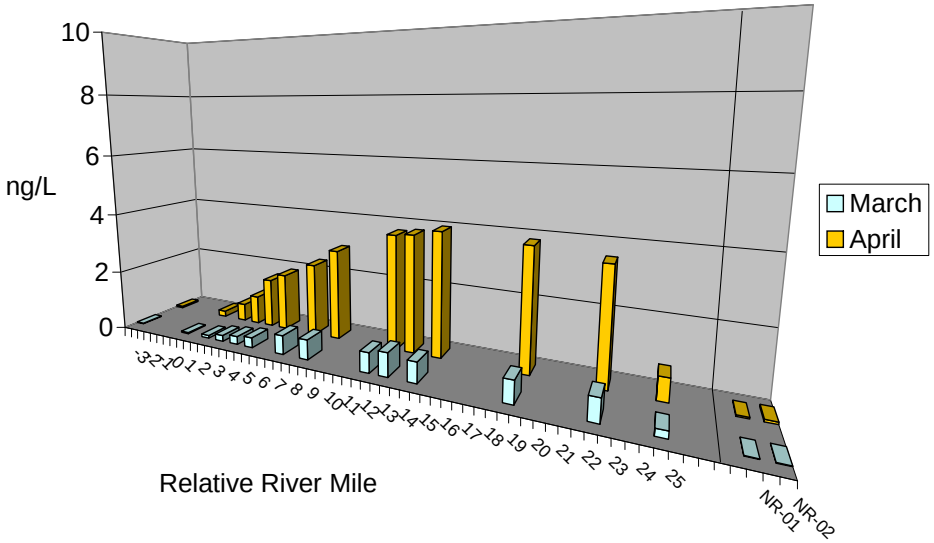
Filtered Total Mercury in Surface Water



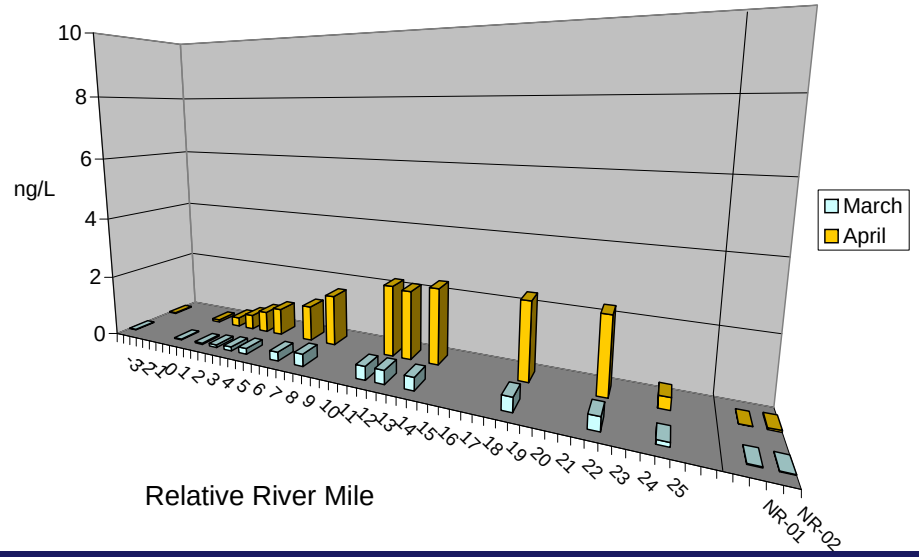
Methylmercury (MeHg) in Surface Water

- MeHg concentrations in both unfiltered and filtered surface water generally increase with distance downriver to ~RRM 11.8
- In unfiltered and filtered surface water, MeHg concentrations increase in April relative to March

Methylmercury in Unfiltered Surface Water

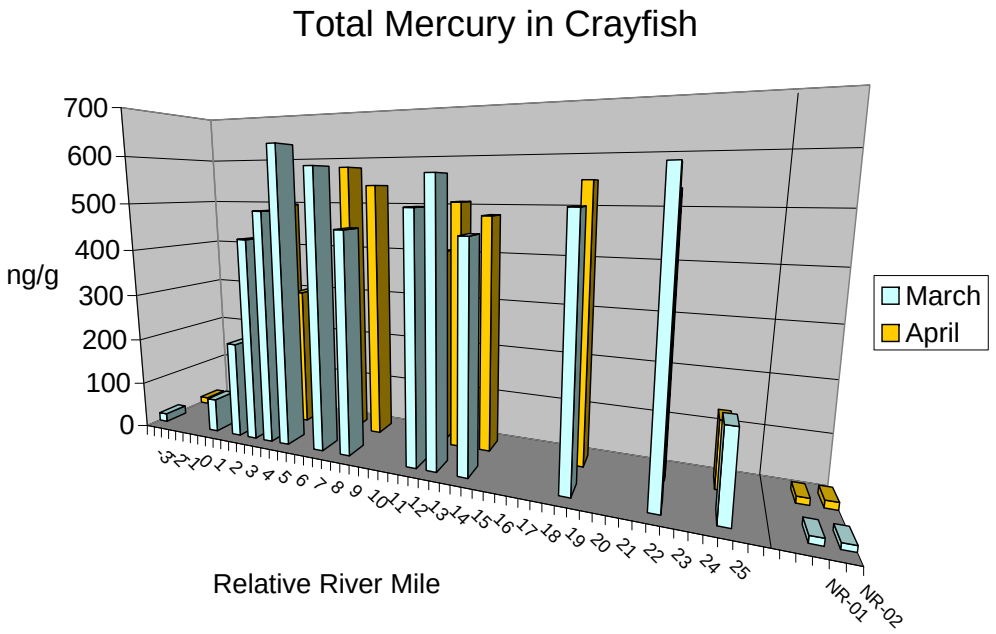


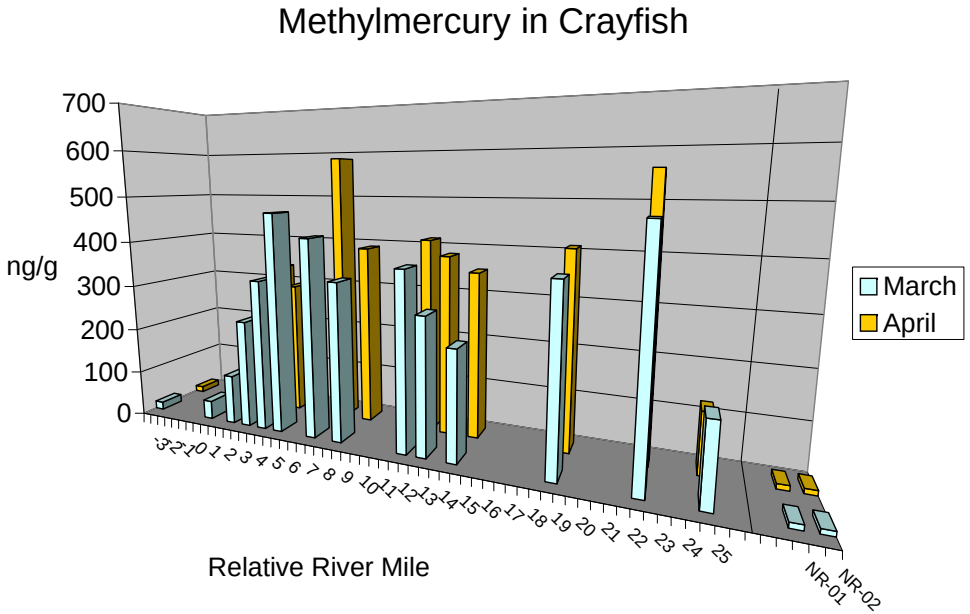
Methylmercury in Filtered Surface Water



Total Mercury (THg) and Methylmercury (MeHg) in Crayfish

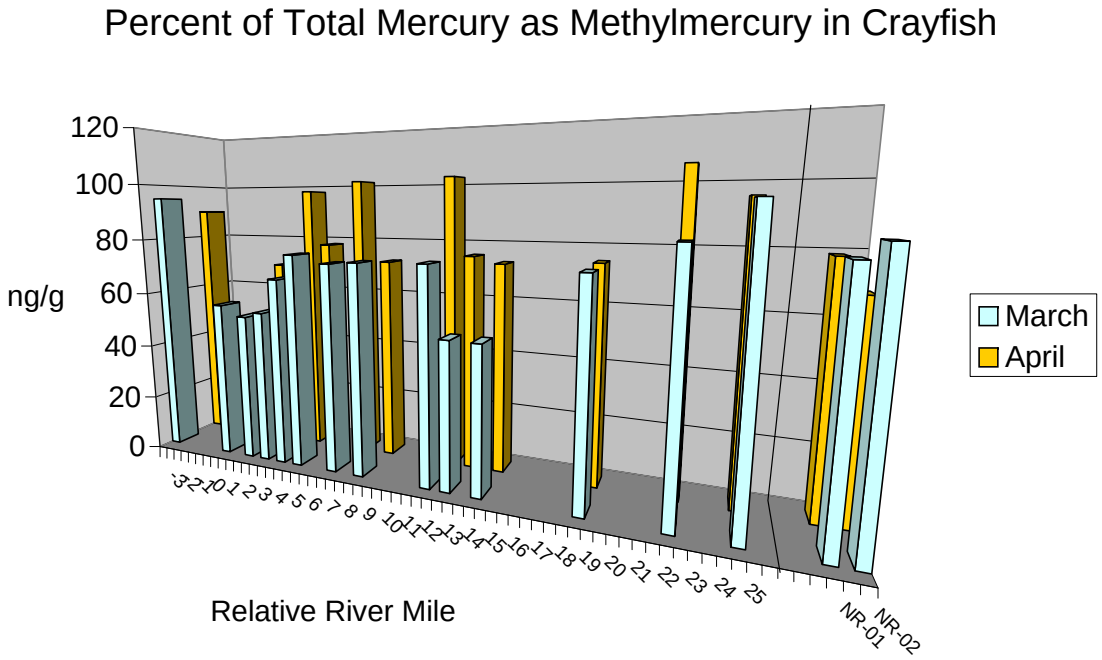
- THg and MeHg concentrations in crayfish tissue increase to ~RRM 5.2 and concentrations are generally maintained along the South River
- No pronounced change in THg or MeHg between March and April
- No significant correlation between crayfish size [within size range sampled (18-25mm carapace length)] and THg and MeHg tissue concentration





Percent of Total Mercury (THg) as Methylmercury (MeHg) in Crayfish

- Percentage of MeHg ranges between 51% and 95%
- Areas with low percentages likely have high particulate – bound THg concentrations that may be present on carapace or in gut contents



Detections of Organic Constituents in Surface Water

Analyte	Units	Total (T) or Dissolved (D)	Screening Criteria (VAWQC)	Number of Detections/ Number of Samples	Minimum Detected	Maximum Detected	Number of Exceedances	Location of Maximum Detection
MARCH								
GAMMA BHC - LINDANE	ug/l	T	NA	2/7	0.0019	0.0025	--	RRM-3.0
HEPTACHLOR	ug/l	T	0.0038	1/7	0.0034	0.0034	--	RRM-8.7
APRIL								
GAMMA BHC - LINDANE	ug/l	T	NA	2/7	0.0019	0.0033	--	RRM-3.0
HEPTACHLOR	ug/l	T	0.0038	1/7	0.0034	0.0034	--	RRM-3.0

Note:

Chronic freshwater values were used for VAWQC screening criteria.

Screening criteria reported in ug/l.

VAWQC - Virginia Ambient Water Quality Criteria (2006)

NA - Not available

Detections of Polycyclic Aromatic Hydrocarbons (PAH) in Sediment

Analyte	Units	Screening Criteria		Number of Detections/ Number of Samples	Minimum Detected	Maximum Detected	Number of Exceedances (TEL)	Location of Maximum Detection
		TEL	PEL					
MARCH								
BENZO(A)ANTHRACENE	ug/kg	31.7	385	1/7	2000	2000	1	RRM-3.0
BENZO(A)PYRENE	ug/kg	31.9	782	1/7	1900	1900	1	RRM-3.0
BENZO(B)FLUORANTHENE	ug/kg	NA	NA	1/7	3400	3400	--	RRM-3.0
BENZO(G,H,I)PERYLENE	ug/kg	NA	NA	1/7	1600	1600	--	RRM-3.0
BENZO(K)FLUORANTHENE	ug/kg	NA	NA	1/7	1400	1400	--	RRM-3.0
CHRYSENE	ug/kg	57.1	862	1/7	2600	2600	1	RRM-3.0
FLUORANTHENE	ug/kg	111	2355	1/7	3800	3800	1	RRM-3.0
INDENO(1,2,3-CD)PYRENE	ug/kg	NA	NA	1/7	1500	1500	--	RRM-3.0
PHENANTHRENE	ug/kg	41.9	515	1/7	1900	1900	1	RRM-3.0
PYRENE	ug/kg	53	875	1/7	3300	3300	1	RRM-3.0
APRIL								
ANTHRACENE	ug/kg	NA	NA	1/7	350	350	--	RRM-3.0
BENZO(A)ANTHRACENE	ug/kg	31.7	385	2/7	580	2500	2	RRM-3.0
BENZO(A)PYRENE	ug/kg	31.9	782	2/7	840	2200	2	RRM-3.0
BENZO(B)FLUORANTHENE	ug/kg	NA	NA	3/7	200	3100	--	RRM-3.0
BENZO(G,H,I)PERYLENE	ug/kg	NA	NA	3/7	130	1200	--	RRM-3.0
BENZO(K)FLUORANTHENE	ug/kg	NA	NA	2/7	580	1100	--	RRM-3.0
CHRYSENE	ug/kg	57.1	862	3/7	150	2900	3	RRM-3.0
DIBENZ(A,H)ANTHRACENE	ug/kg	NA	NA	2/7	180	410	--	RRM-3.0
FLUORANTHENE	ug/kg	111	2355	3/7	200	2900	3	RRM-3.0
INDENO(1,2,3-CD)PYRENE	ug/kg	NA	NA	2/7	680	1000	--	RRM-3.0
PHENANTHRENE	ug/kg	41.9	515	2/7	790	1800	2	RRM-3.0
PYRENE	ug/kg	53	875	3/7	190	3600	3	RRM-3.0

Note:

NA - Not available

Screening criteria reported in ug/kg.

Detections of PAH in Crayfish

Analyte	Units	Number of Detections/ Number of Samples	Minimum Detected	Maximum Detected	Location of Maximum Detected
MARCH					
ACENAPHTHYLENE	ug/kg	1/7	12	12	NR-01
ANTHRACENE	ug/kg	1/7	150	150	NR-01
BENZO(A)ANTHRACENE	ug/kg	1/7	150	150	NR-01
BENZO(A)PYRENE	ug/kg	1/7	140	140	NR-01
BENZO(B)FLUORANTHENE	ug/kg	1/7	150	150	NR-01
BENZO(G,H,I)PERYLENE	ug/kg	1/7	150	150	NR-01
BENZO(K)FLUORANTHENE	ug/kg	1/7	150	150	NR-01
CHRYSENE	ug/kg	2/7	12	160	NR-01
DIBENZ(A,H)ANTHRACENE	ug/kg	1/7	140	140	NR-01
FLUORANTHENE	ug/kg	1/7	150	150	NR-01
FLUORENE	ug/kg	1/7	51	51	NR-01
INDENO(1,2,3-CD)PYRENE	ug/kg	1/7	150	150	NR-01
PHENANTHRENE	ug/kg	1/7	130	130	NR-01
PYRENE	ug/kg	1/7	150	150	NR-01
APRIL					
ACENAPHTHENE	ug/kg	2/7	15	17	RRM-3.0
ACENAPHTHYLENE	ug/kg	2/7	8.7	20	RRM-3.0
ANTHRACENE	ug/kg	6/7	5.9	130	RRM-3.0
BENZO(A)ANTHRACENE	ug/kg	4/7	9.4	180	RRM-3.0
BENZO(A)PYRENE	ug/kg	5/7	11	160	RRM-3.0
BENZO(B)FLUORANTHENE	ug/kg	3/7	30	170	RRM-3.0
BENZO(G,H,I)PERYLENE	ug/kg	4/7	17	150	RRM-3.0
BENZO(K)FLUORANTHENE	ug/kg	3/7	30	160	RRM-3.0
CHRYSENE	ug/kg	6/7	9.3	170	RRM-3.0
DIBENZ(A,H)ANTHRACENE	ug/kg	4/7	12	130	RRM-3.0
FLUORANTHENE	ug/kg	5/7	13	170	RRM-3.0
FLUORENE	ug/kg	3/7	12	54	RRM-3.0
INDENO(1,2,3-CD)PYRENE	ug/kg	4/7	17	140	RRM-3.0
NAPHTHALENE	ug/kg	1/7	11	11	NR-01
PHENANTHRENE	ug/kg	5/7	7.3	120	RRM-3.0
PYRENE	ug/kg	7/7	13	200	RRM-3.0

Fish community

Species	NR-01[1]	NR-02[1]	SR-01[2]	RRM-0.6[2]	RRM-5.2[2]	RRM-11.8[2]	RRM-14.6[2]	RRM-19.0[2]	RRM-22.4[1]	SFS-01[1]
Anguillidae										
American Eel	1	1			2					
Catostomidae										
Hognose Sucker		2	24	3	13	5	7	6	10	1
Torrent Sucker			35		1					
White Sucker	9	2	62	21	31	22	1		2	7
Centrarchidae										
Bluegill	2		2			1				
Green Sunfish	8	2	4	5	1	1	1	2	5	3
Largemouth Bass					5	1		1		
Pumpkinseed	14		1		1					
Redbreast Sunfish	20	12		2	24	48	4	11	16	1
Rock Bass	23	5	11	6	7	4	1	6	3	2
Smallmouth Bass	2	4	1	9	6	12	10	25	26	9
Cottidae										
Mottled Sculpin	3	9	185	330	51	1			1	
Potomac Sculpin	6	6	8	9	1			6	3	
Cyprinidae										
Blacknose Dace			57	6					1	
Bluehead Chub		10	5	3	12	6	78	14	1	24
Bluntnose Minnow	14	4	1			4				7
Carp		1				3				
Central Stoneroller			11	1					2	
Common Shiner		1	50	1			5			4
Creek Chub						2				
Cutlips Minnow	18	7	8	1						
Cyprinid Sp.	5						1			3
Fallfish			25	10	21	24	8		10	
Fathead Minnow			2							
Golden Shiner						1				
Longnose Dace	6	30	70	37	4	5	40	45	82	5
Rosyface Shiner	6	1	10	5			2	4	1	18
Rosyside Dace			2							
Spotfin Shiner	4				5	1	7	1	6	2
Spottail Shiner	207	12	41					1		30
Ictaluridae										
Brown Bullhead					1					
Margined Madtom	1	6		2	1	1	20	10	8	8
Yellow Bullhead	1	2		1	1	14		1	10	22
Percidae										
Fantail Darter			5	9						1
Tessellated Darter					1				1	
Salmonidae										
Brown Trout			2	4				3		
Rainbow Trout				7				5	1	
Total # of Fish	**350**	**117**	**622**	**472**	**189**	**156**	**185**	**141**	**189**	**147**
Total # of Species	**19**	**19**	**24**	**21**	**20**	**19**	**14**	**16**	**19**	**17**

[1] Sampled with 2 Backpack electrofishers

[2] Sampled with Tote-barge electrofisher

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