

Summary of Recent Surface Water Hg Concentrations and Loading Results

“What We Know Now”

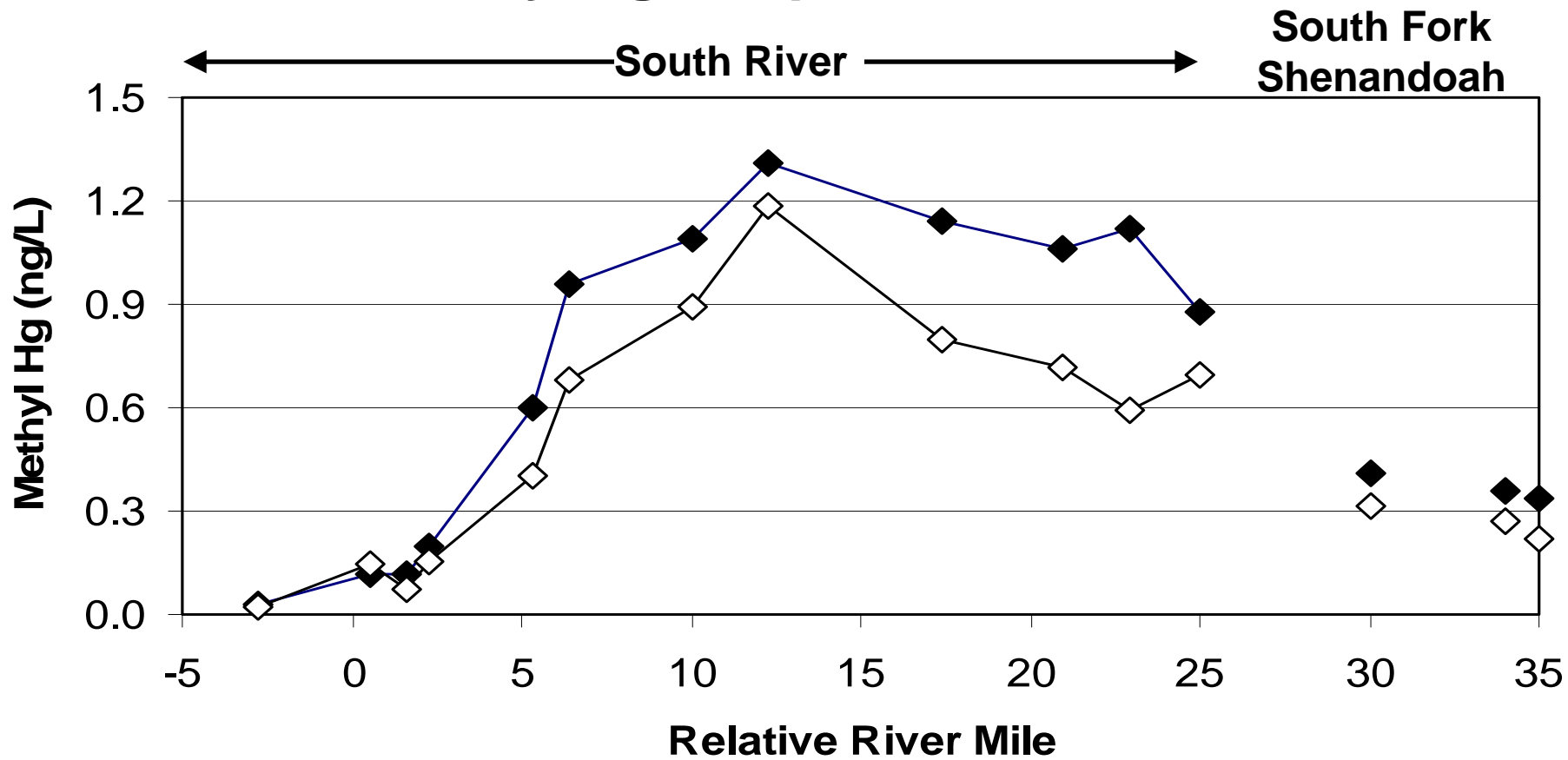
Surface Water Sampling Events (Dupont)

Sample Dates	Design	Analytes	Harriston Discharge (cfs)	Water Temperature (C)
August 24, 2004	Whole River	Tot/Diss/TSS	204	18 to 23
September 28-29, 2004	Whole River (Storm)	Tot/Diss/TSS	3450-4070	
January 18, 2005	Intensive (RRM0 to 5.4)	Dissolved only	423	2.4 to 3.1
February 7, 2005	Whole River	Tot/Diss/TSS	201	5.5 to 8.9
March 16, 2005	Intensive (RRM5.4 to 10)	Dissolved only	322	7.6 to 8.0
May 25-26, 2005	Intensive (RRM0 to 25)	Dissolved only	199 -182	14 to 18
September 13, 2005	Whole River (+ Transverse)	Tot/Diss/TSS	66	16 to 22

Longitudinal and Transverse Sampling Patterns

Can Reveal Points/Areas of Hg
Loading

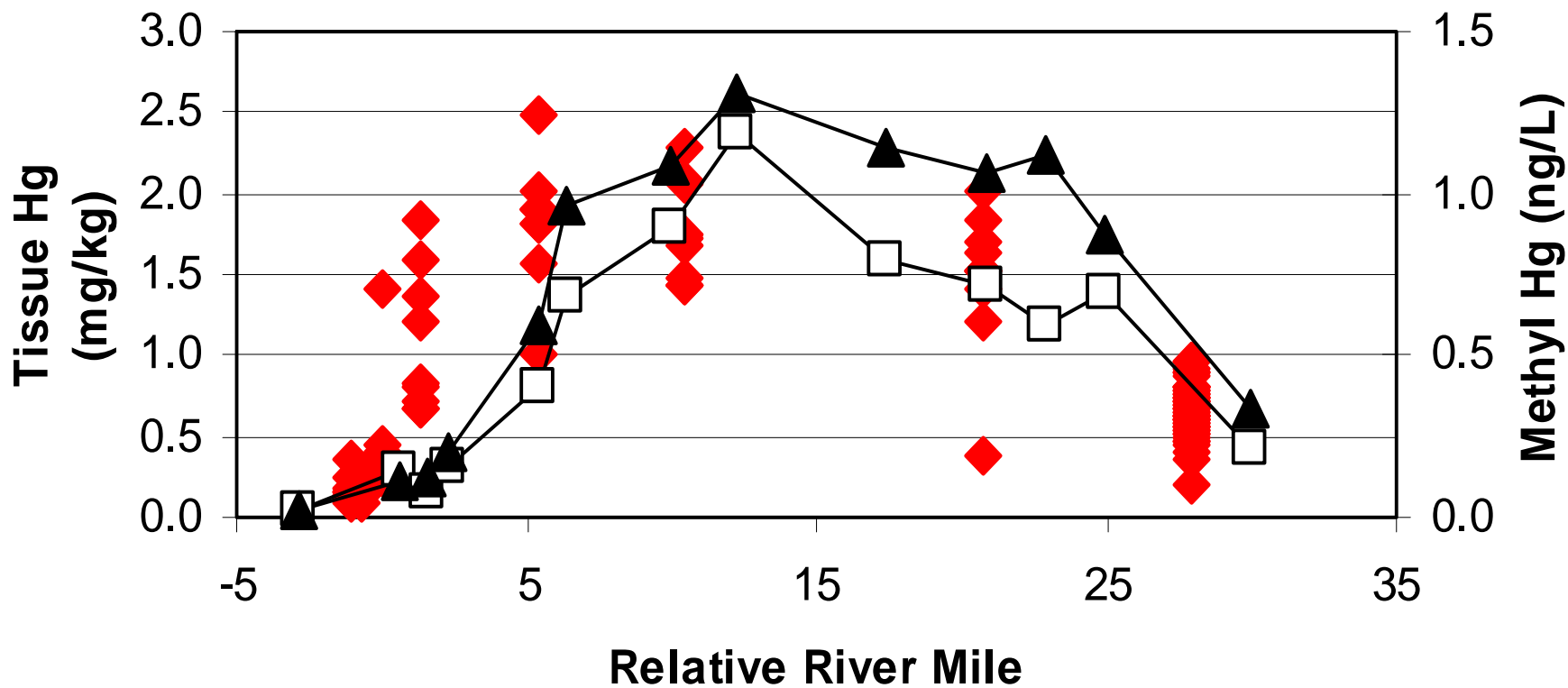
Methyl Hg - September 2005



—◆— Total Methyl Hg —◇— Dissolved Methyl Hg

Smallmouth Bass - 2002

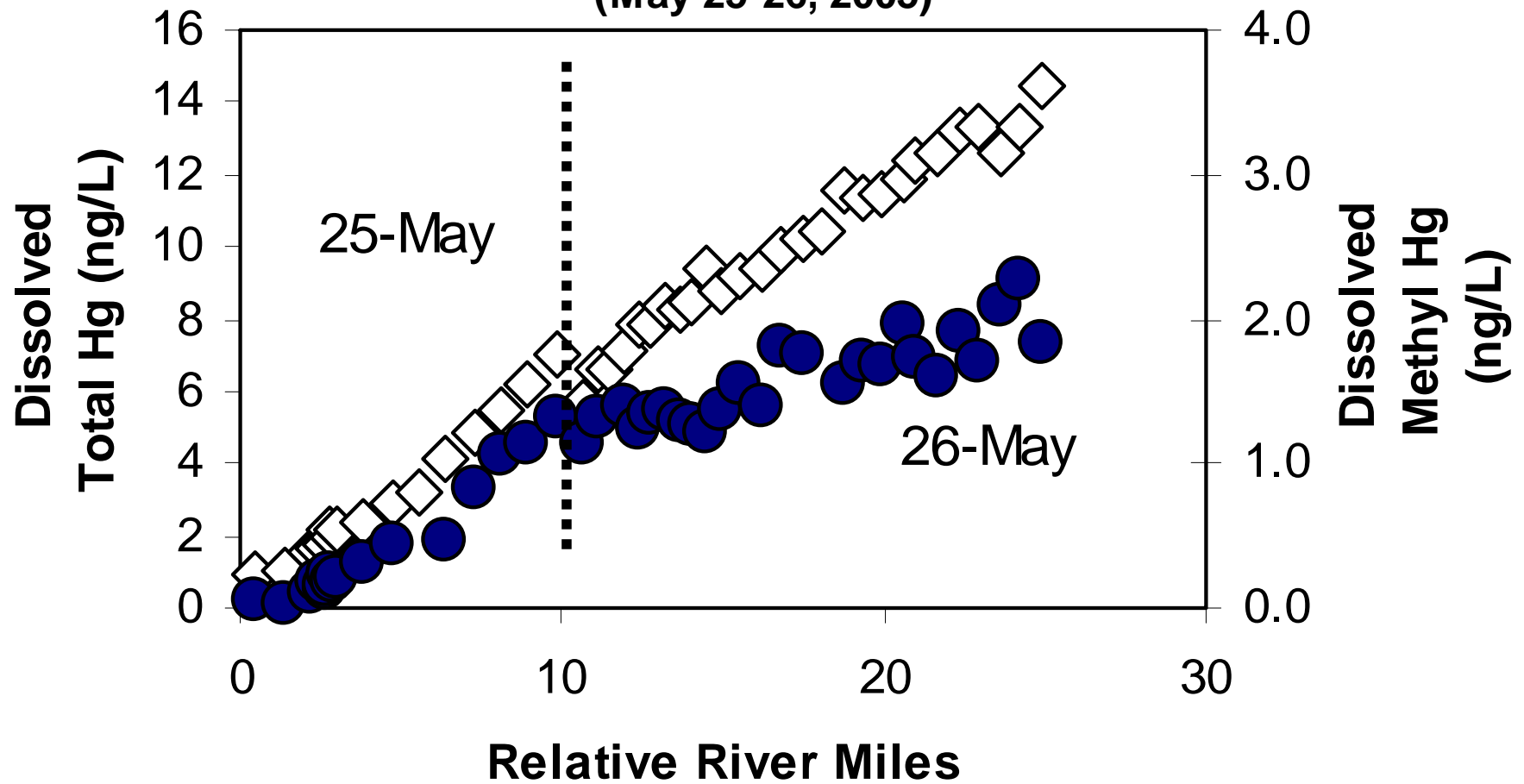
Methyl Hg - Sept 2005



◆ Smallmouth Bass —□— Dissolved MeHg —▲— Total MeHg

Dissolved Hg vs Distance

(May 25-26, 2005)

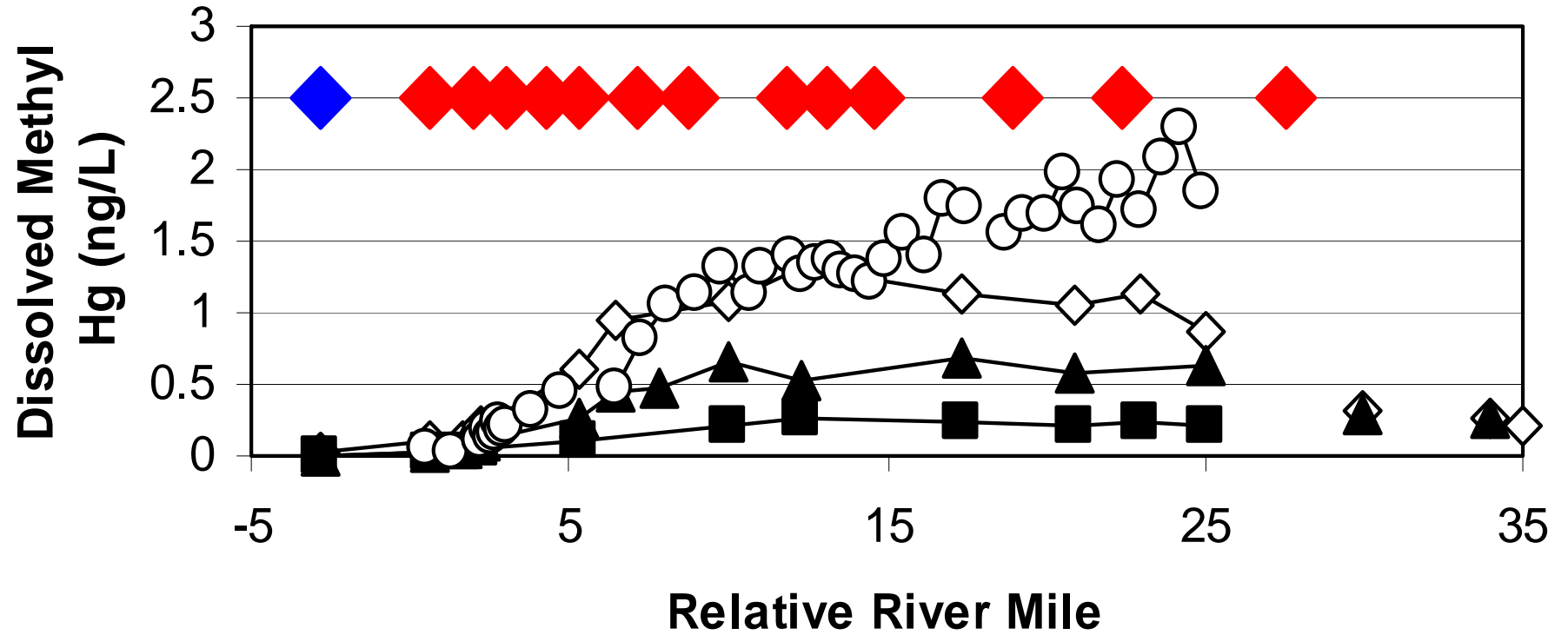


◇ Dissolved Total Hg ● Dissolved Methyl Hg

Dissolved Methyl Hg

← South River →

South Fork
Shenandoah



—◇— Sep-05

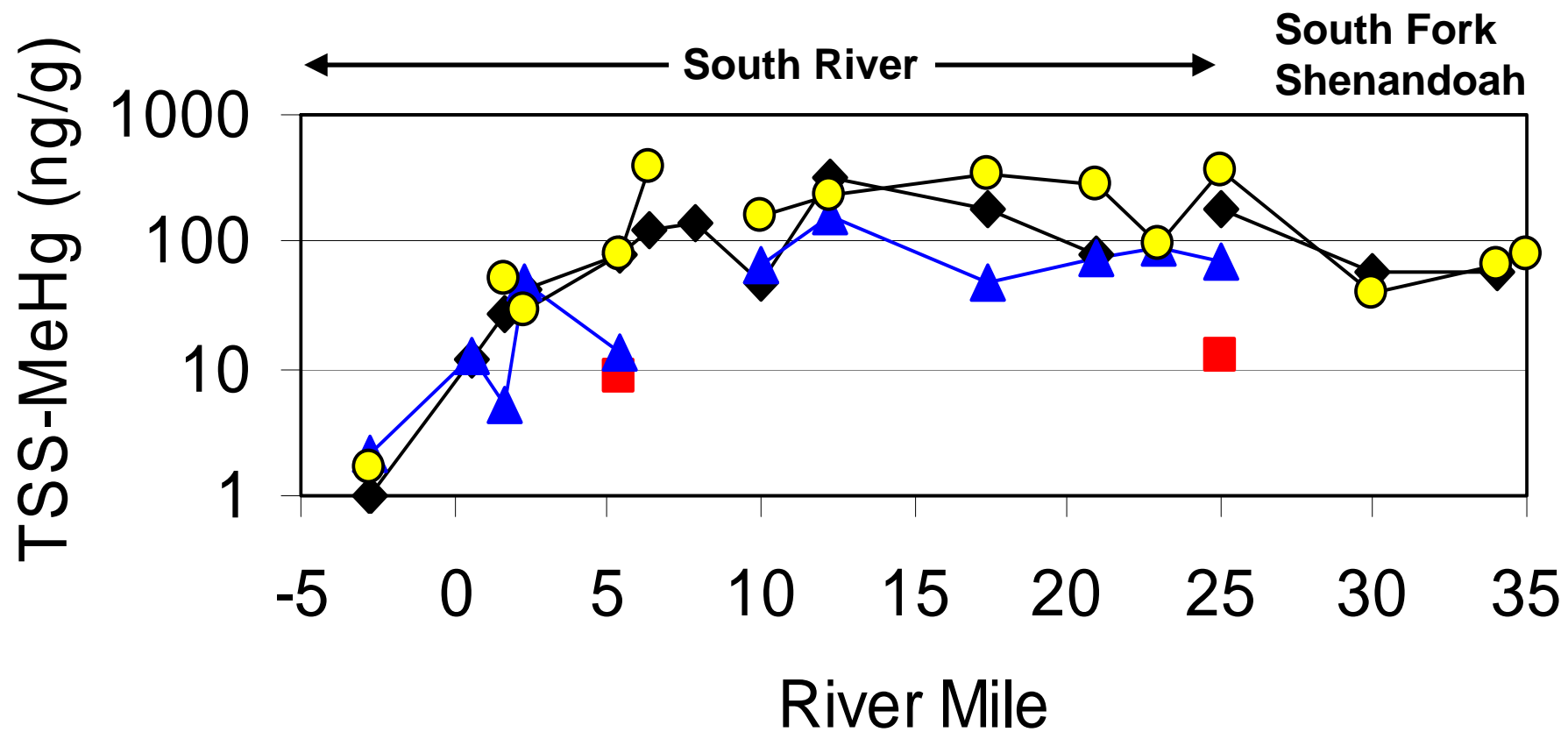
—■— Feb-05

—▲— Aug-04

—○— May-05

◆ EcoStudy Stations

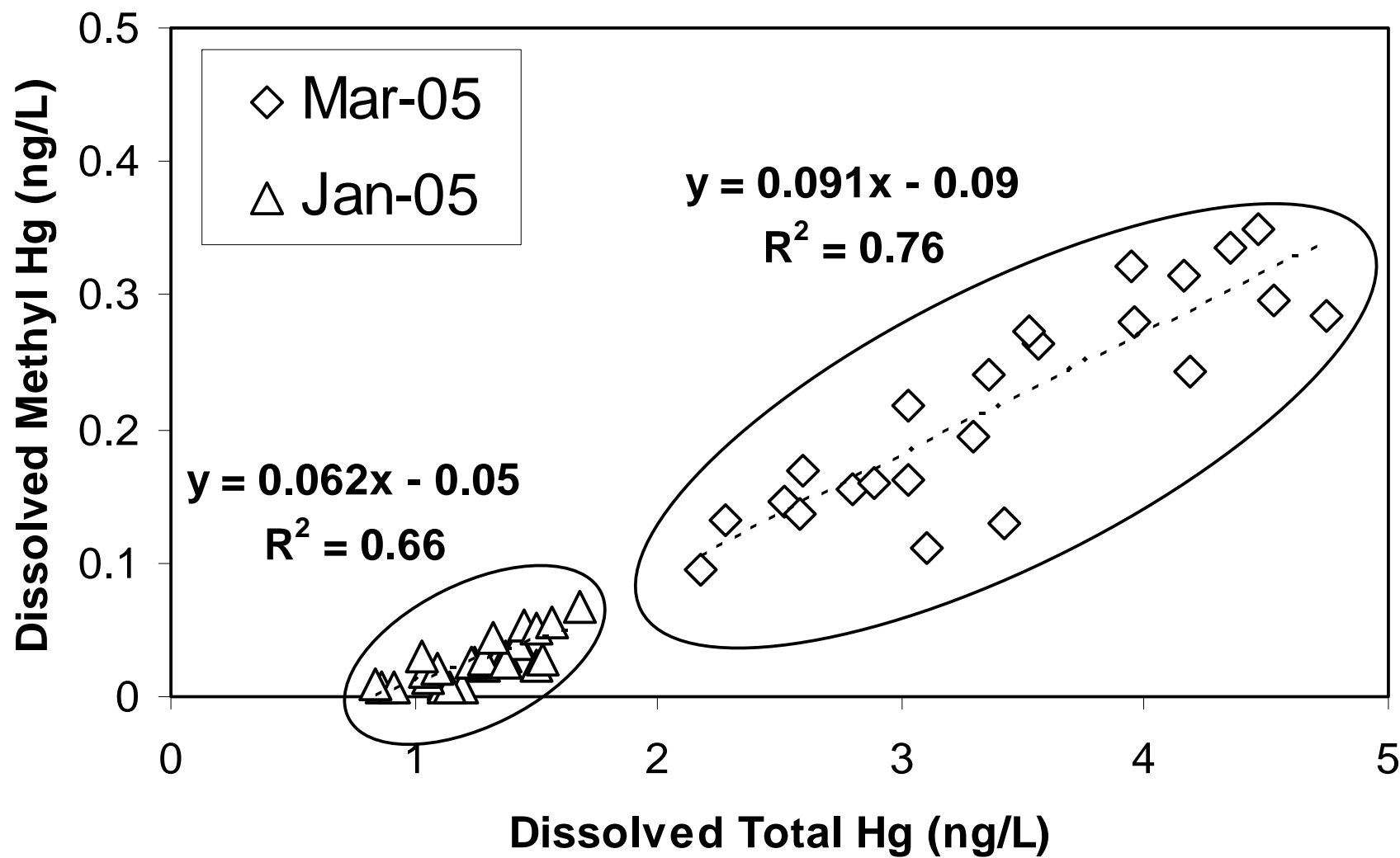
Methyl Hg on Suspended Matter



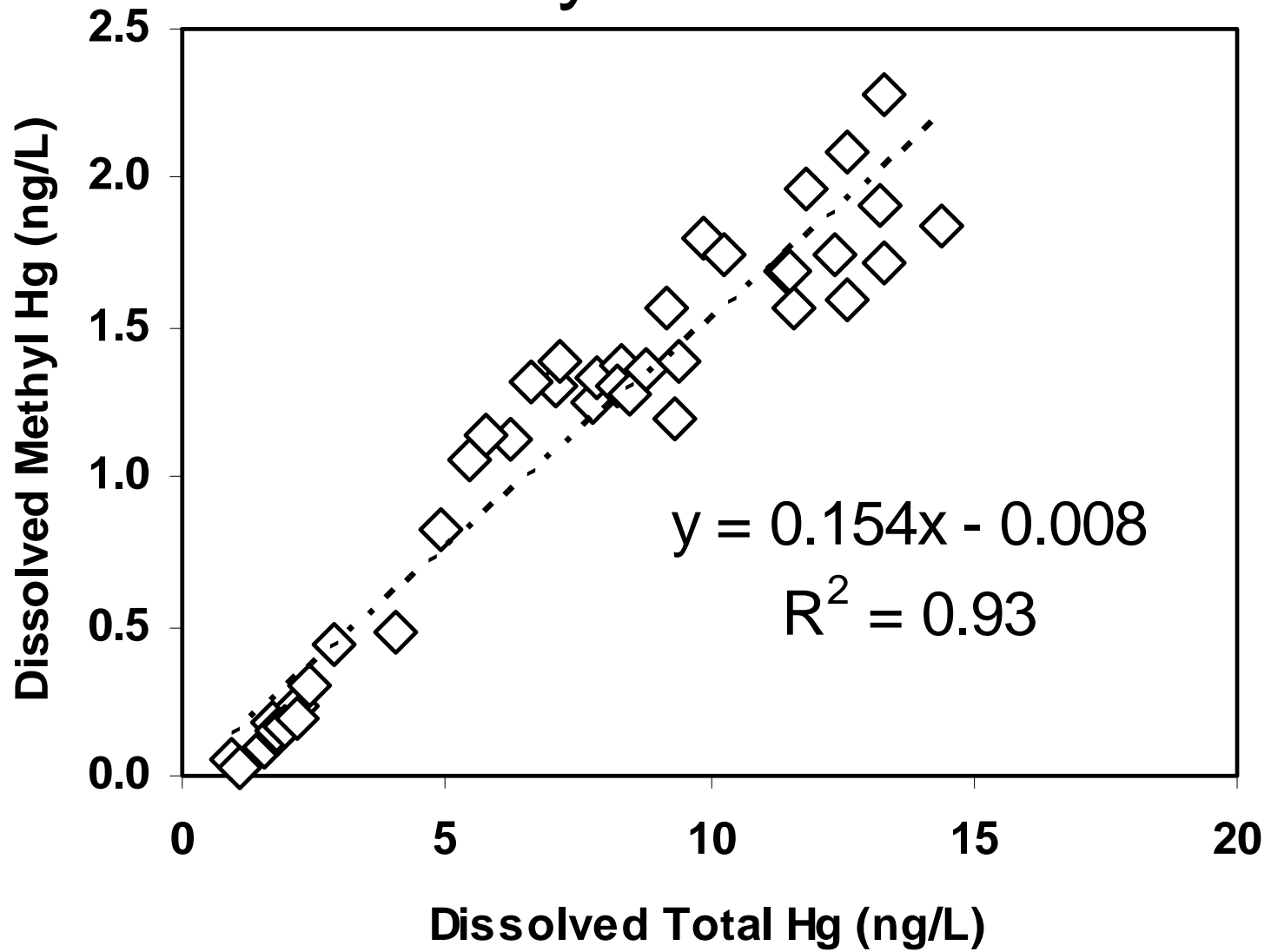
◆ Aug-04 ■ Flood 2004 ▲ Feb-05 ● Sep-05

Is Total Hg a Good Surrogate
for Methyl Hg?

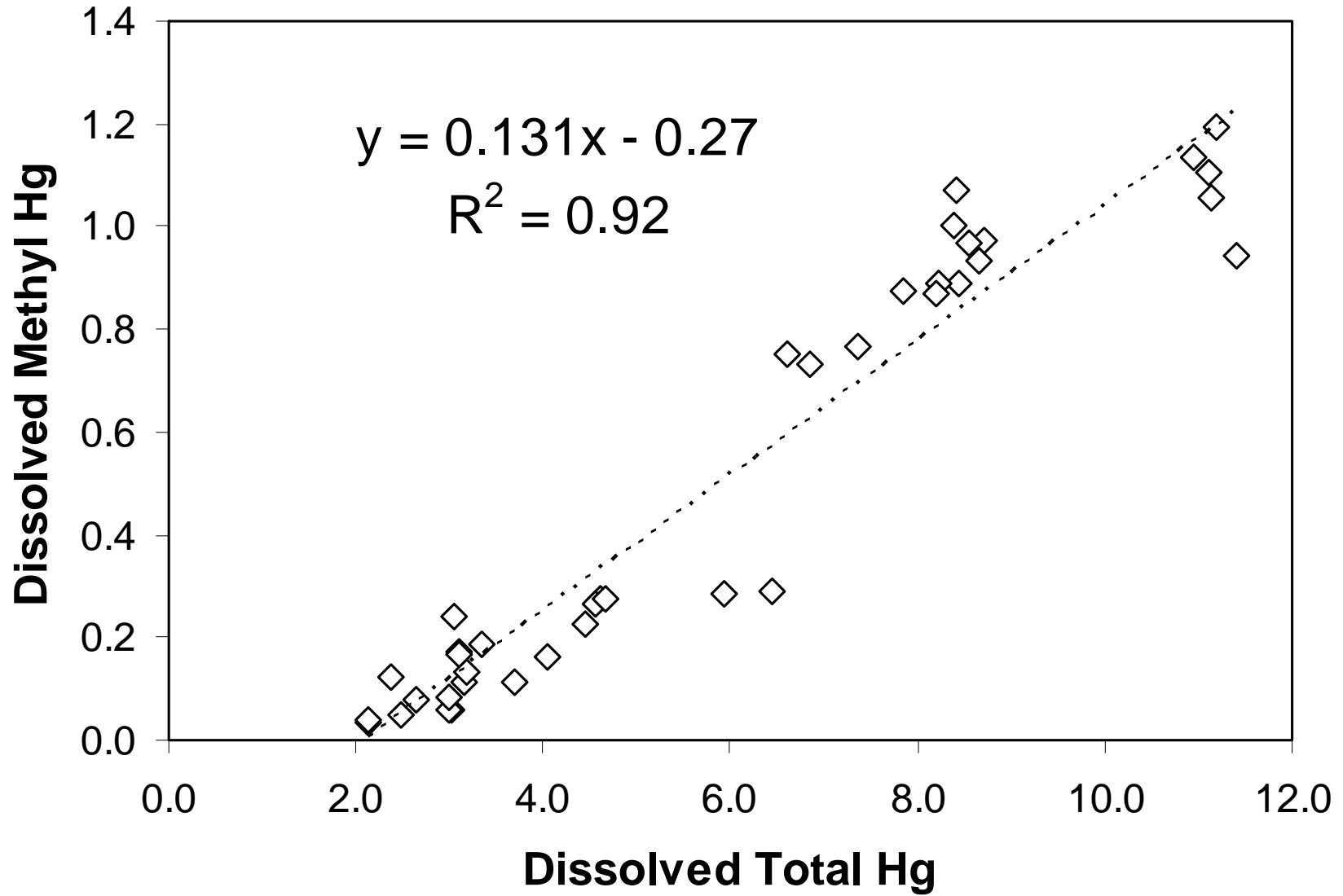
January and March 2005



May 2005



Sep05 Transect Data



Transverse Patterns

To Detect Near-Bank Inputs

- During one close-interval longitudinal survey (March 2005) a few near-bank samples were collected for comparison to mid-stream samples. Most were higher in both dissolved total and dissolved methyl Hg.
- Subsequently (May 2005) two reaches were sampled in detail across the direction of flow with similar findings.
- In September 2005 an additional 9 reaches were sampled across the direction of flow.

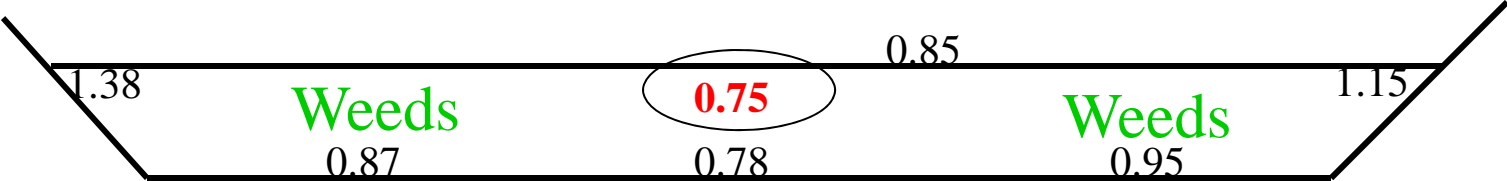
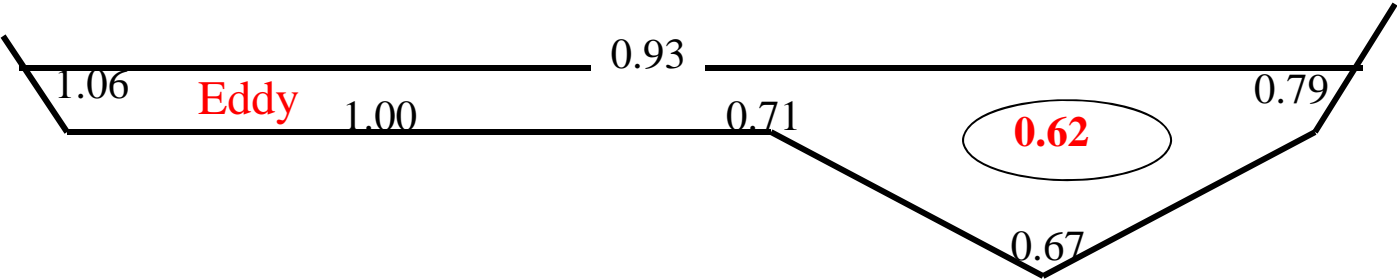
Transect Results Near Dooms

(RRM 5.5)

Methyl Hg Dissolved (ng/L)

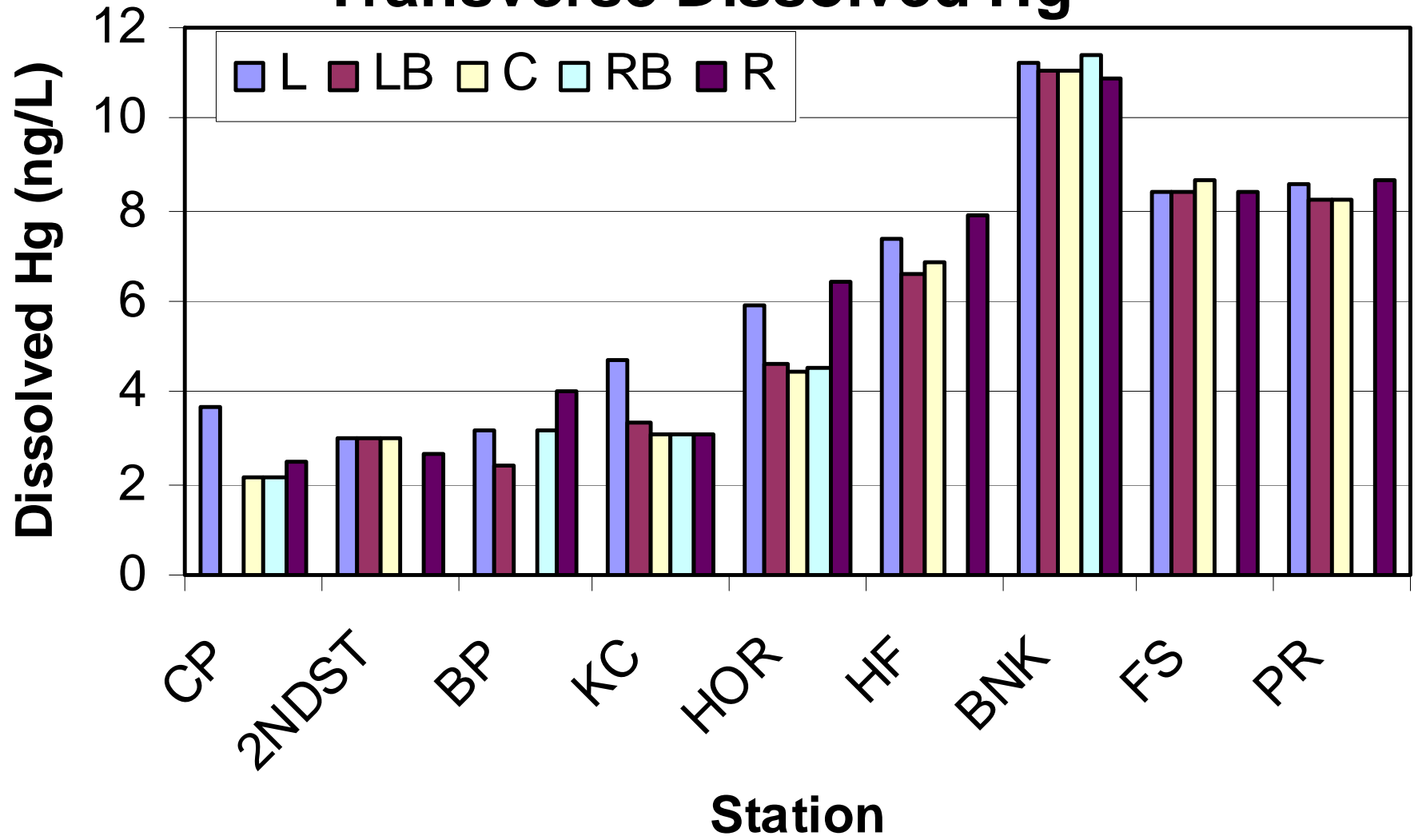
East

West

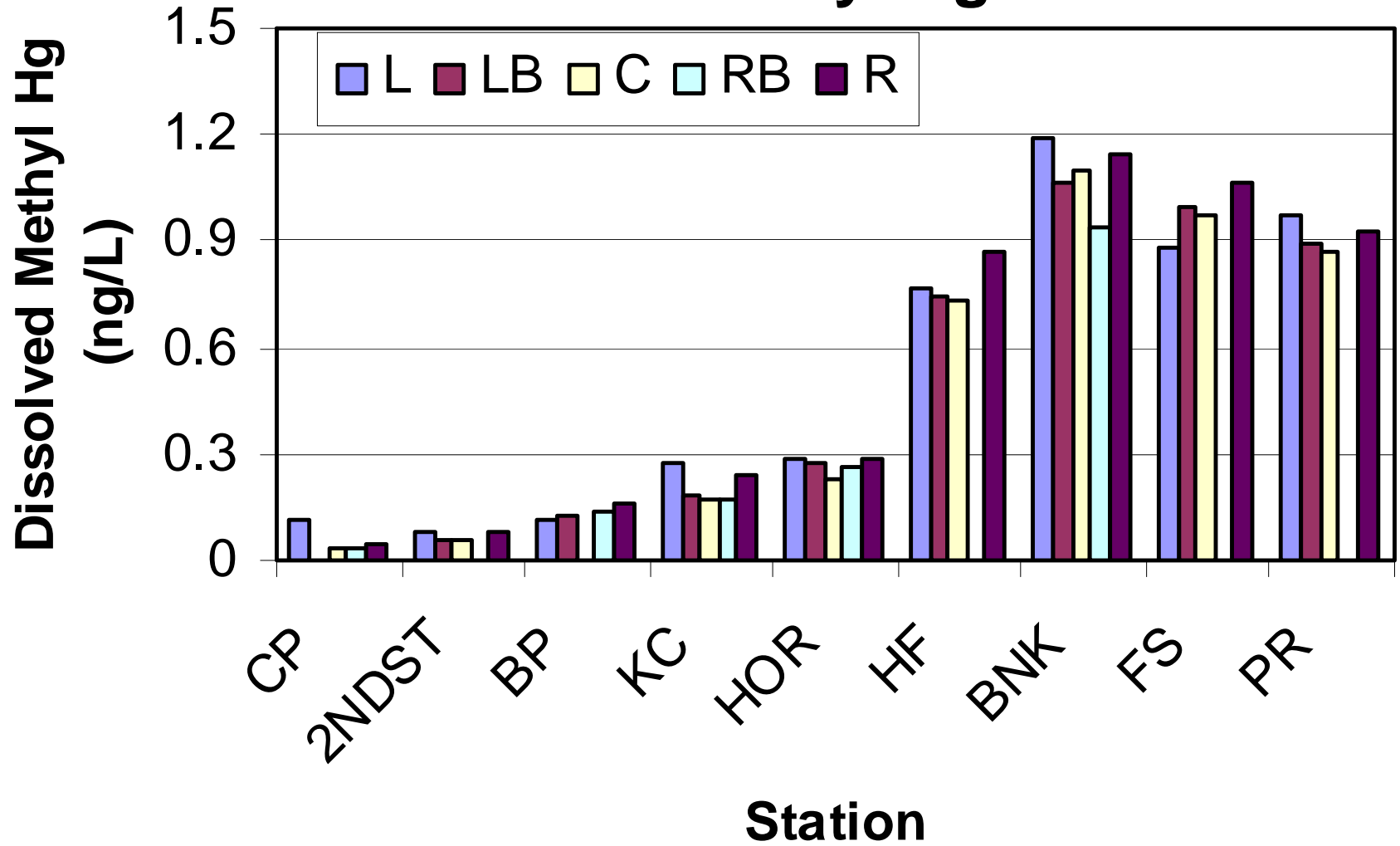


 Thalweg sampling position

Transverse Dissolved Hg



Transverse Methyl Hg



Preliminary Loading Estimates

- Internal - Based on flows and concentrations in river water column
 - So far limited to dissolved phases
 - To be supplemented using BFC studies
- External – Tributaries, outfalls etc

Hg Loading (Internal)

- South River Reach to Reach (“River as a Flux Chamber” Dissolved only)
 - Plant to Dooms
 - Total = 0.5 to 1.2 g/day (3.9 to 7.3 $\mu\text{g}/\text{m}^2/\text{day}$)
 - Methyl = 0.04 to 0.2 g/day (0.27 to 1.3 $\mu\text{g}/\text{m}^2/\text{day}$)
 - BFC Methyl @ Dooms = 1.4 $\mu\text{g}/\text{m}^2/\text{day}$
 - Dooms to Crimora
 - Total = 1.4 to 1.7 g/day (9.3 to 11 $\mu\text{g}/\text{m}^2/\text{day}$)
 - Methyl = 0.17 to 0.32 g/day (1.1 to 2.1 $\mu\text{g}/\text{m}^2/\text{day}$)
 - Crimora to Port Republic (May05 data only)
 - Total = 4.3 g/day (9.1 $\mu\text{g}/\text{m}^2/\text{day}$)
 - Methyl = 0.52 g/day (1.1 $\mu\text{g}/\text{m}^2/\text{day}$)

Preliminary Methylmercury Loading Estimates

Location	Mean Flow (cfs)	Concentration		Tributary Loading		South River Loading	
		Low (ng/L)	High (ng/L)	Low (mg/d)	High (mg/d)	Low (mg/d)	High (mg/d)
USGS (RRM-2.7)	149	0.01	0.05			3.65	18.2
Invista Plant	5.4	0.03	0.05	0.40	0.66		
Rockfish Run	5	0.03	no data	0.37	no data		
Wayne STP	4.18	0.12	0.68	1.23	6.95		
Oxbow	6.12	0.2	4.1	2.99	61.4		
Hopeman Pk (RRM2.5)	214	0.15	0.2			78.5	105
Genicom	0.17	no data	3	no data	1.25		
Dooms (RRM5.5)	235	0.21	0.61			121	351
USGS (RRM17)	262	0.37	1.1			237	705
Port Republic (RRM25)	333	0.31	1.1			253	896

Where is Hg Entering the South River?

- Tributary (point source) loadings appear to be insignificant.
- Some tributary inputs (e.g. Oxbow, Genicom) can have significantly elevated methyl Hg **concentrations**, especially in warm season but flows too low at these times to affect concentrations in the river.
- Most significant **dissolved** loading is “internal” and **distributed** relatively evenly down the river. May be directly or indirectly derived from floodplain soils or alluvial groundwater.

How Is Mercury Entering the South River?-Two Hypotheses

- A Small But Significant “*Soluble and Methylatable*” Fraction of Mercury in Contaminated Floodplain Soils Is Released Into Surface Water When Soils Fall Into, or Are Entrained by, the River.
- Alluvial Groundwater Is Elevated in *Soluble and Methylatable* Hg and Enters the River at a Relatively Constant Rate Along the Length of the River.

