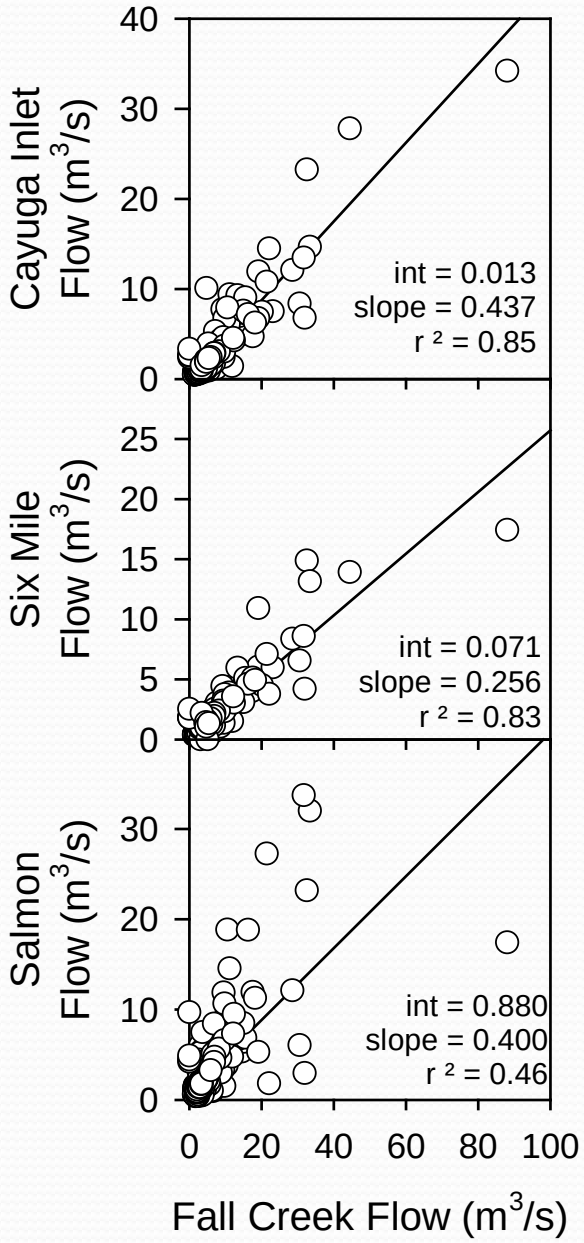
2013 Cayuga Lake Tributary Water Quality: Preliminary Analysis

Anthony R. Prestigiacomo

Results: Comparison of Daily Flow Records

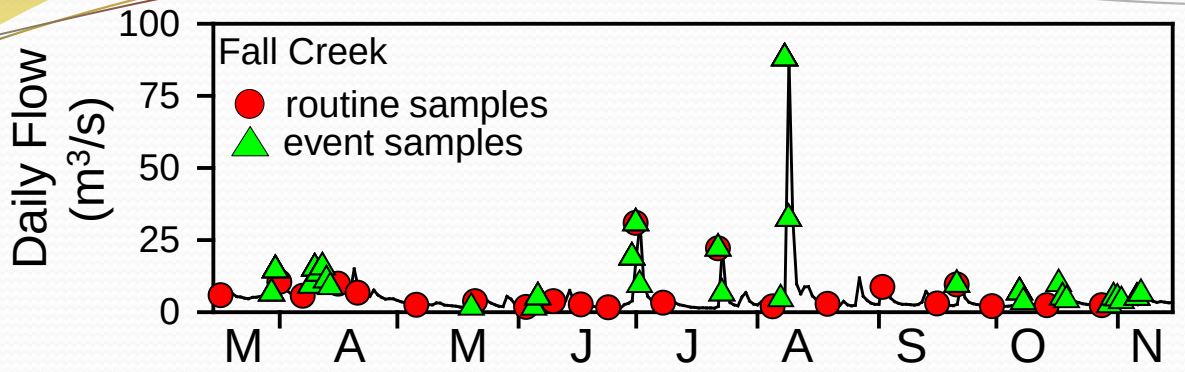
- 2013 study interval
- to be expanded for longer-term records
- support model hindcasting and scenarios



Preliminary Estimates of Epilimnetic Flushing

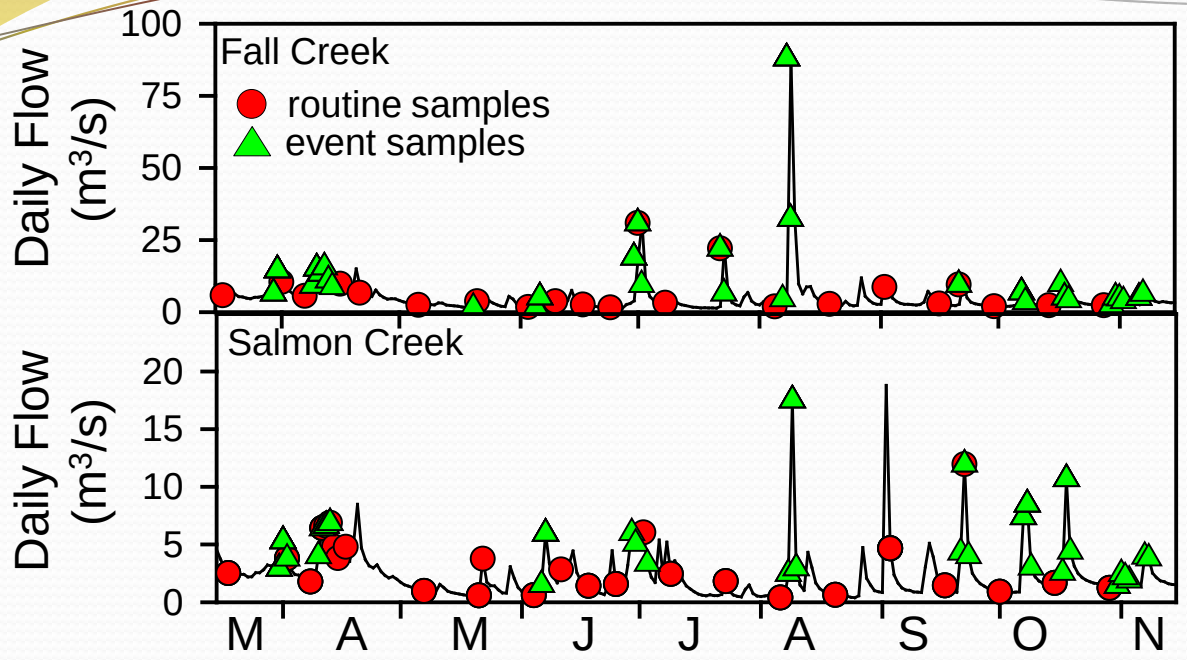
- first approximation
- assumptions
  - epilimnetic depth of 10 m
  - ungaged tributary flow estimates according to watershed area ratios to Fall Creek
  - tributaries enter the epilimnion
- flushes = average Q_{TOTAL} (m^3/d) ÷ lake vol. (0-10m) x time for May – September interval (152 d)
- number of flushes of epilimnion over May – September interval = 0.18

Sampling Coverage in 2013



- 97 samples
- 41% flow sampled

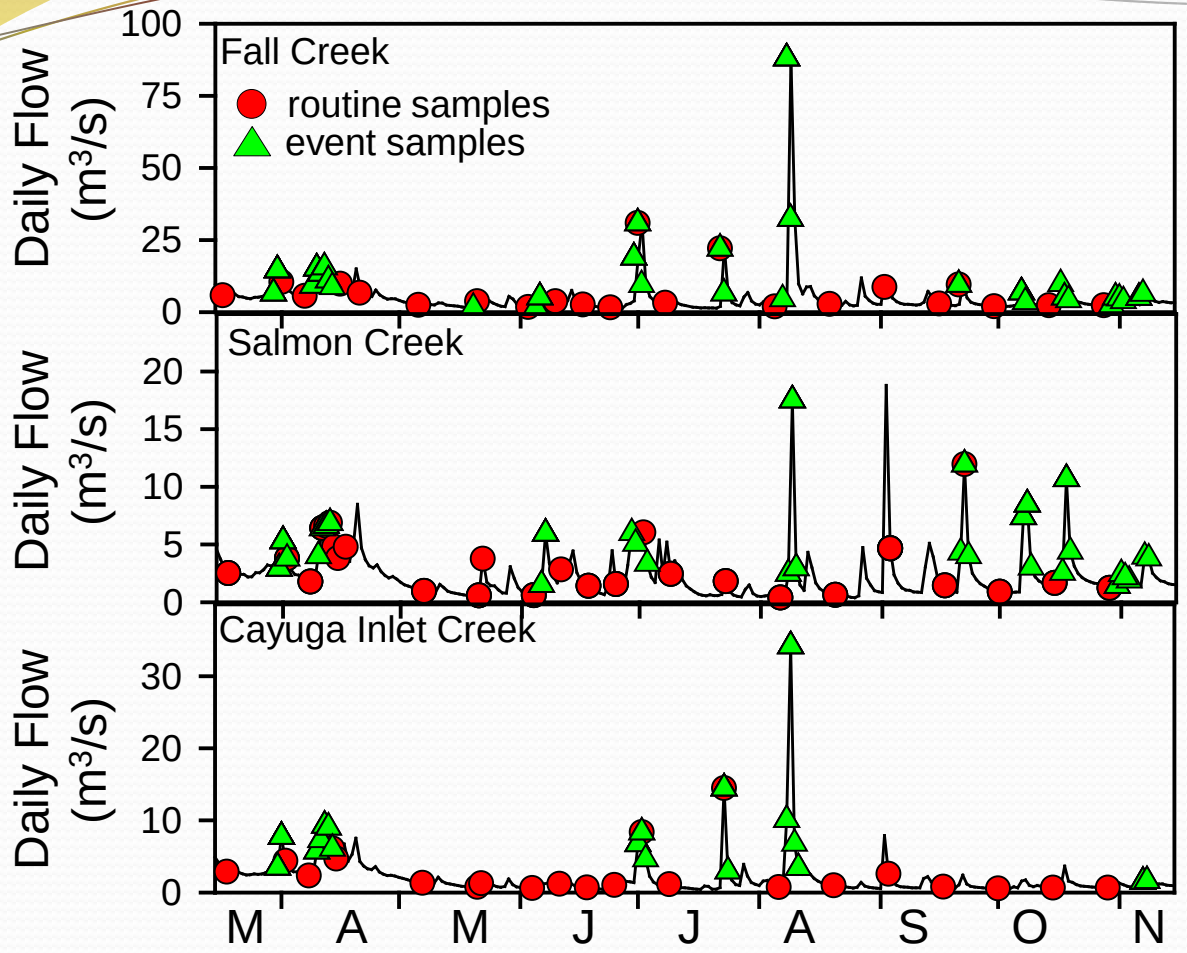
Sampling Coverage in 2013



- 97 samples
- 41% flow sampled

- 132 samples
- 32% flow sampled

Sampling Coverage in 2013

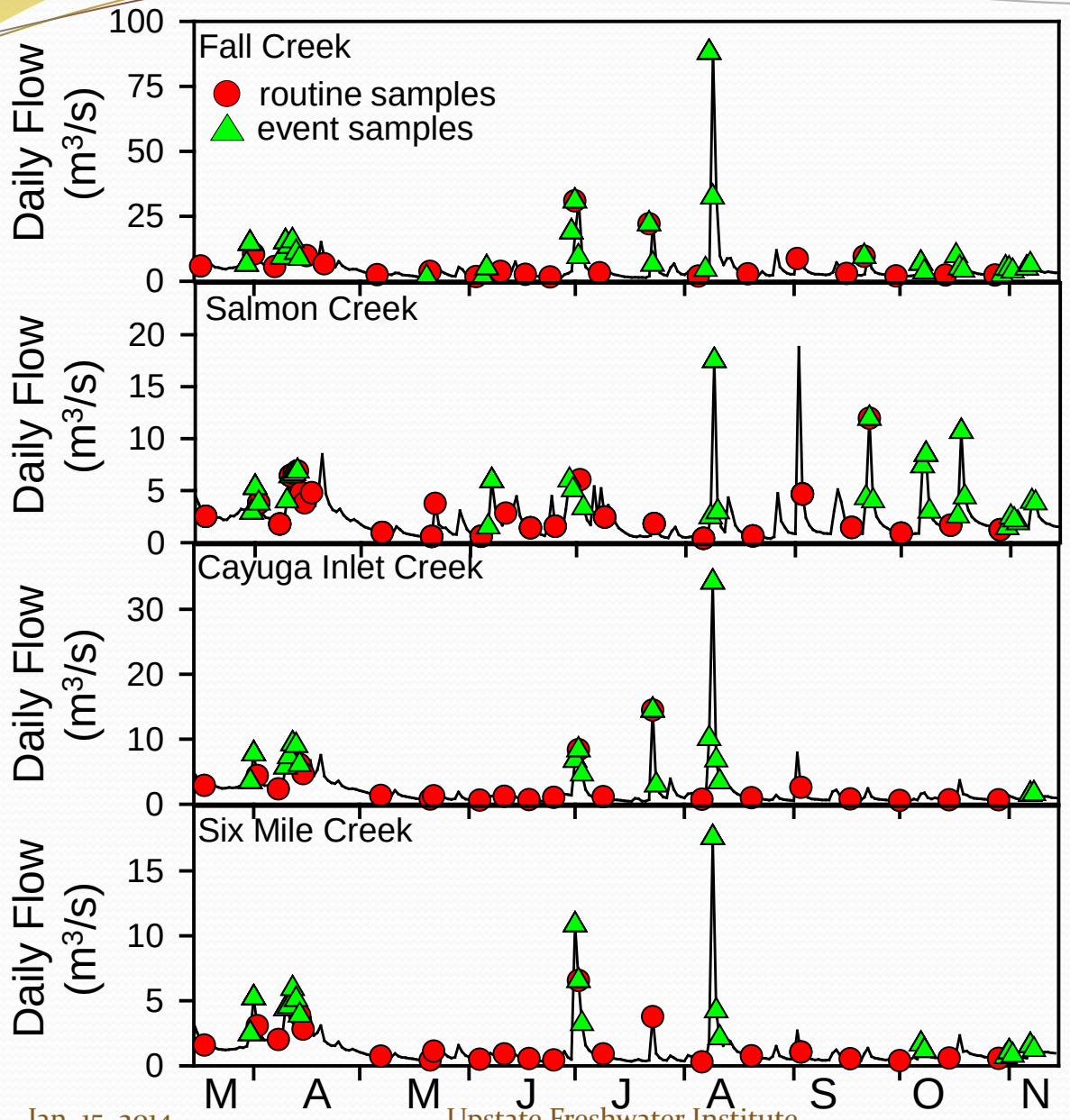


- 97 samples
- 41% flow sampled

- 132 samples
- 32% flow sampled

- 71 samples
- 38% flow sampled

Sampling Coverage in 2013



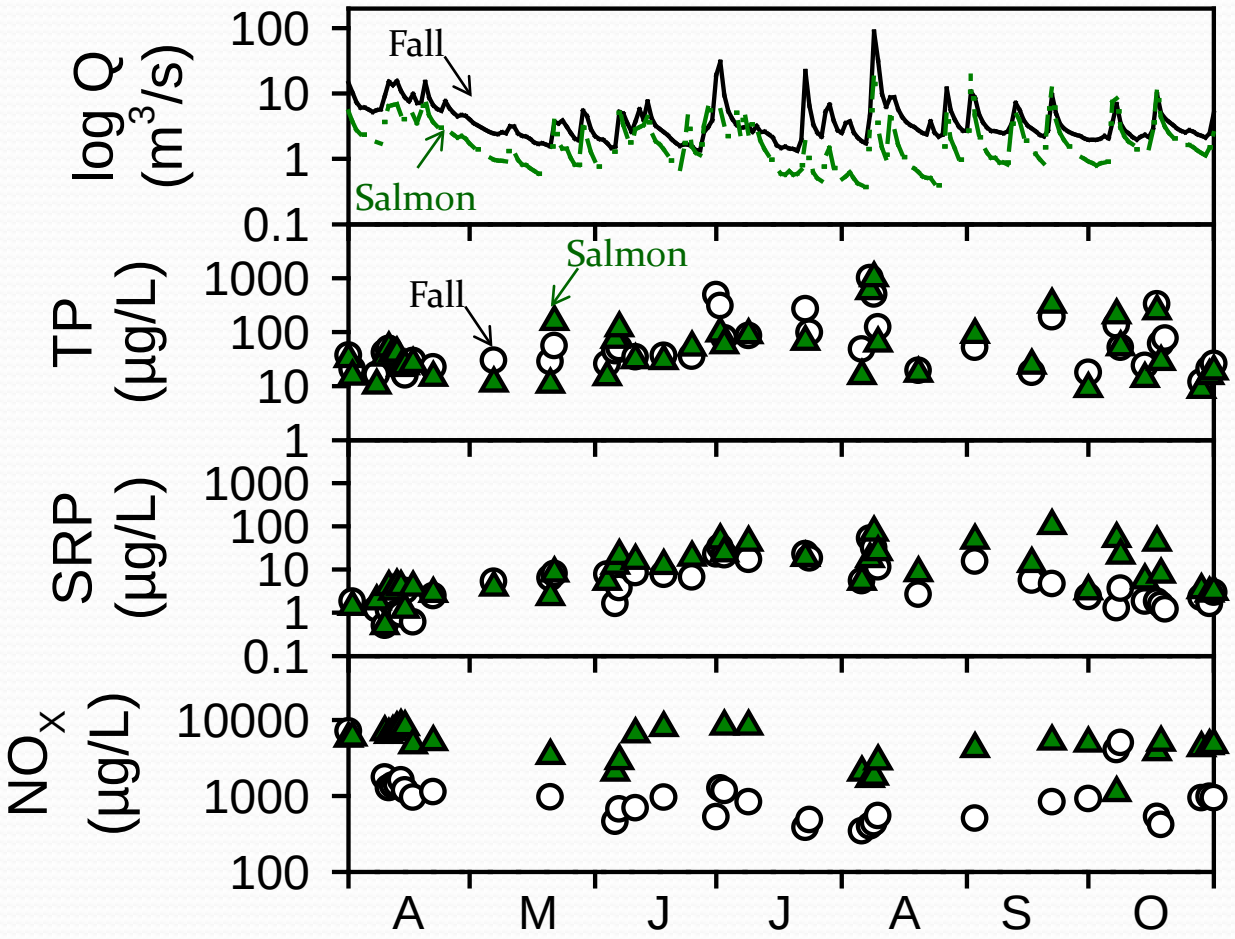
- 97 samples
- 41% flow sampled

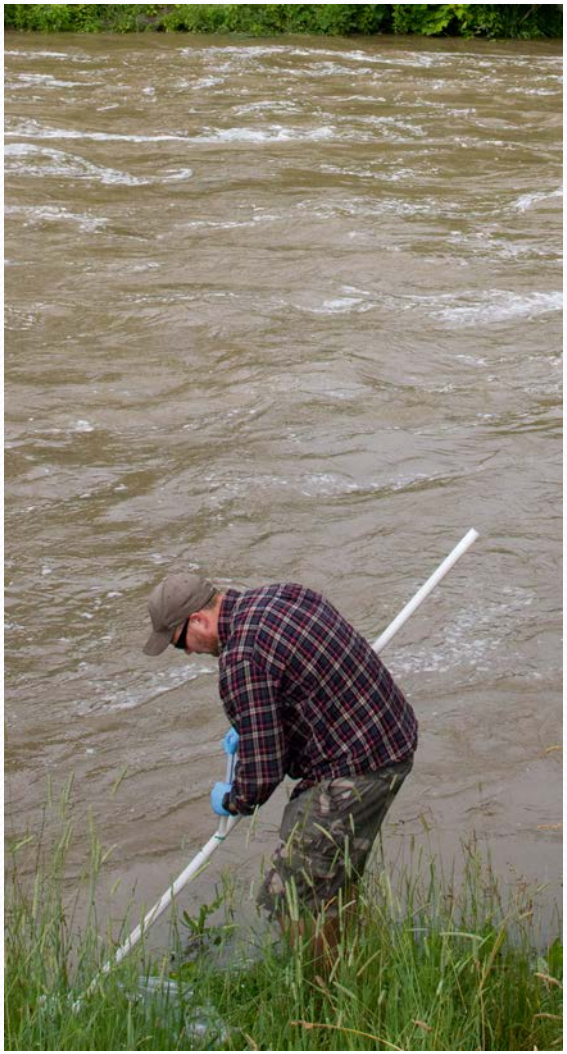
- 132 samples
- 32% flow sampled

- 71 samples
- 38% flow sampled

- 79 samples
- 37% flow sampled

Results:
Time Series of Selected Constituents





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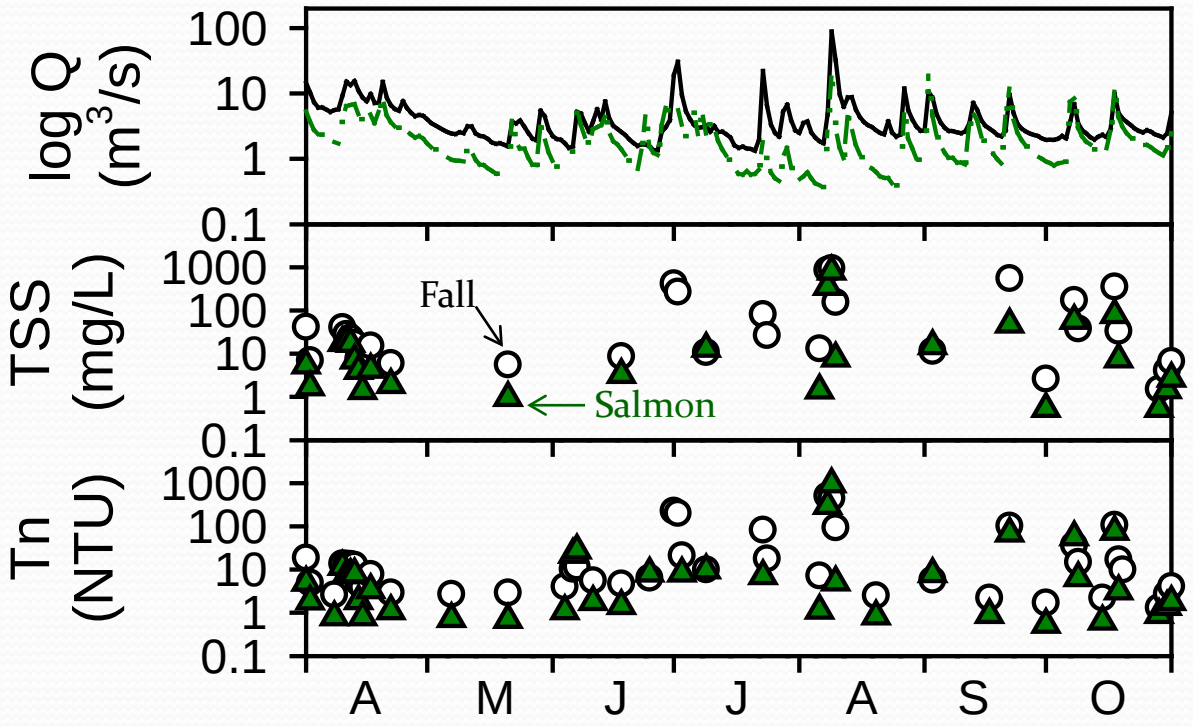
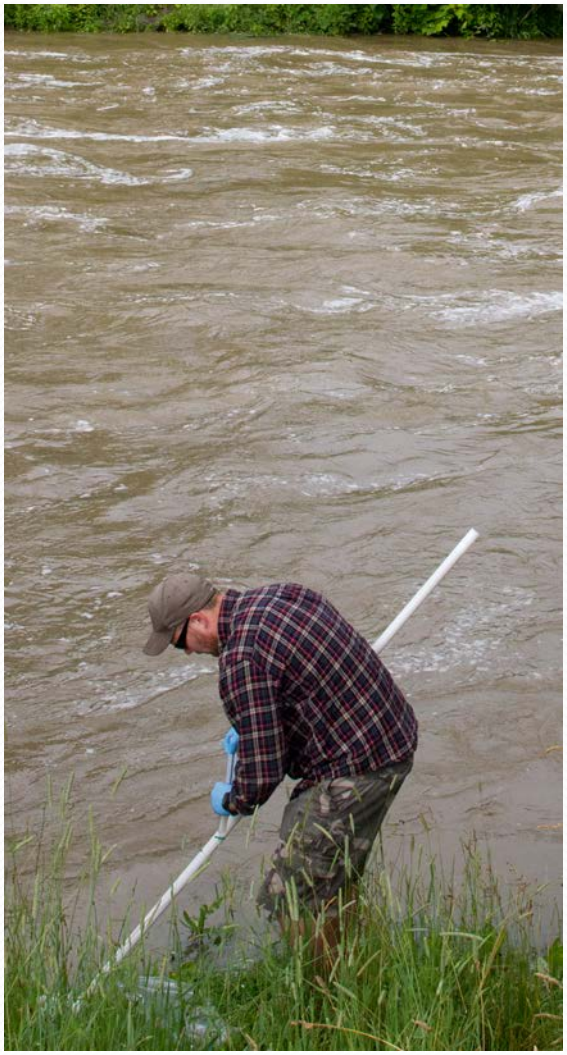
Time Series of Selected Constituents





Results: Basic Statistics

- medians (maximum obs. in parentheses)

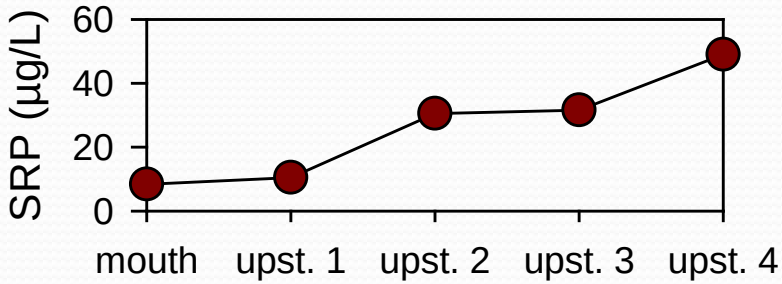
Tributary	TP (µg/L)	TDP (µg/L)	PP (µg/L)	SRP (µg/L)	t-NH_3 (µg/L)	NO_X (mg/L)
Fall Creek	**51.3 (997)**	9.2 (69)	40.6 (927)	3.5 (52)	**19.5 (659)**	0.94 (18?)
Salmon Creek	43.7 **(3,257)**	**13.7 (134)**	25.3 (3,203)	**8.3 (133)**	21.0 (113)	**4.7 (10.4)**
Cayuga Inlet	27.4 **(12,674)**	5.7 (49)	21.8 **(12,640)**	1.8 (30)	20.0 (50)	0.41 (1.21)
6 Mile Creek	37.5 (539)	8.9 (90)	27.8 (510)	5.8 (81)	21.0 (51.0)	0.27 (0.57)
Taughannock Creek	11.6 (1066)	5.3 (43.2)	5.8 (122.9)	1.4 (24.7)	21.5 (44)	0.11 (3.3)

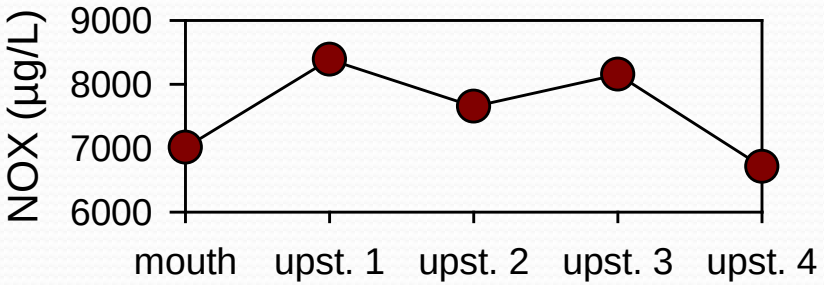
Results: Basic Statistics

- medians (maximum obs. in parentheses)

Tributary	Tn NTU)	FSS (mg/L)	FSS:TSS	PP:FSS	PP:TP	SRP:TDP
Fall Creek	13.0 (916)	30.4 (2,439)	0.87	0.0021	0.78	0.39
Salmon Creek	5.7 (3,905)	6.1 (2,720)	**0.80**	**0.0048**	**0.57**	**0.58**
Cayuga Inlet	13.7 (12,368)	31.5 (8,712)	0.88	0.0018	0.78	0.39
6 Mile Creek	19.5 (942)	31.6 (734)	0.85	0.0027	0.74	0.53
Taughannock Creek	1.1 (34.9)	1.9 (14.1)	0.74	0.0056	0.54	0.31

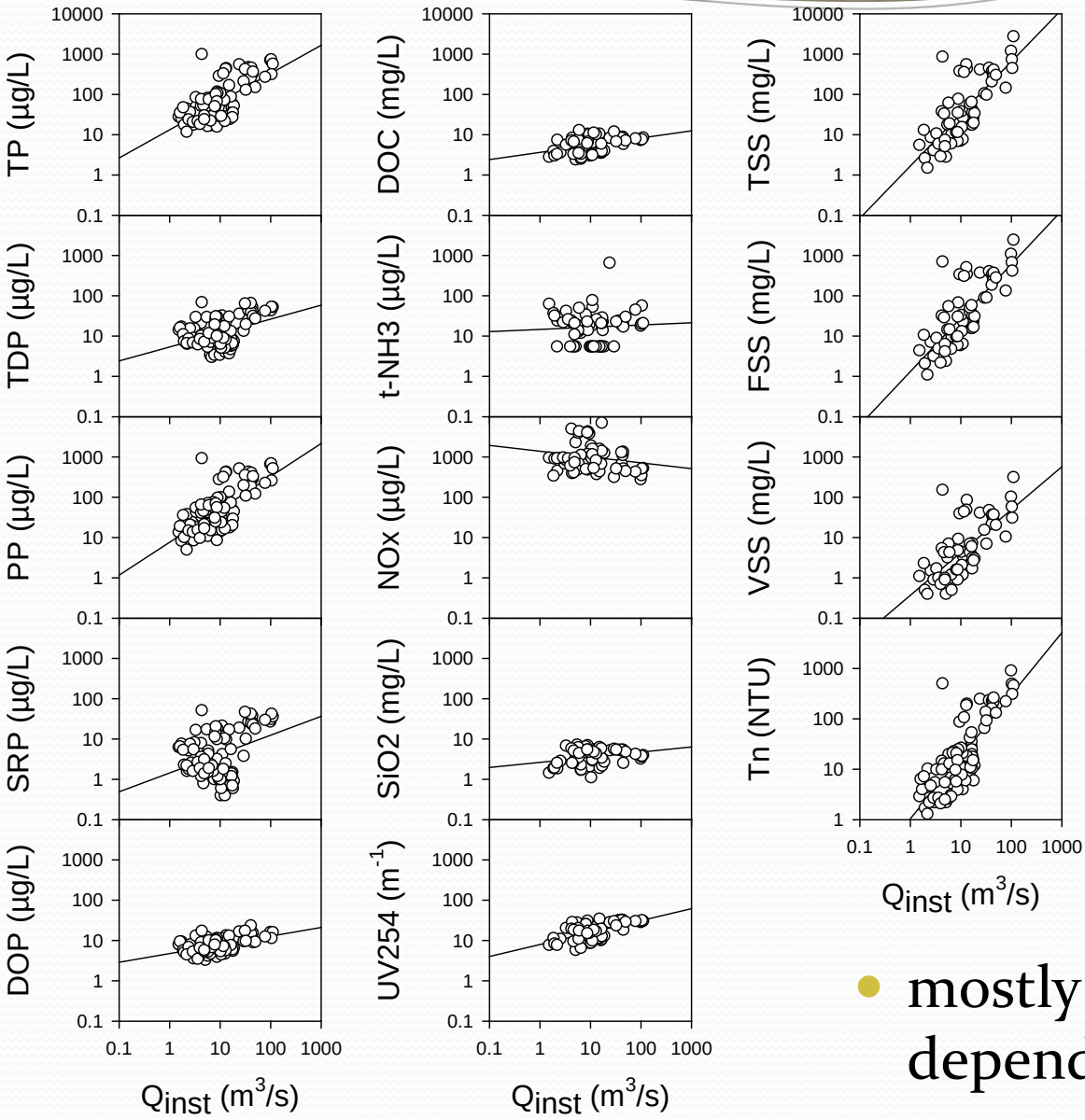
Results:
Salmon Creek Longitudinal Patterns





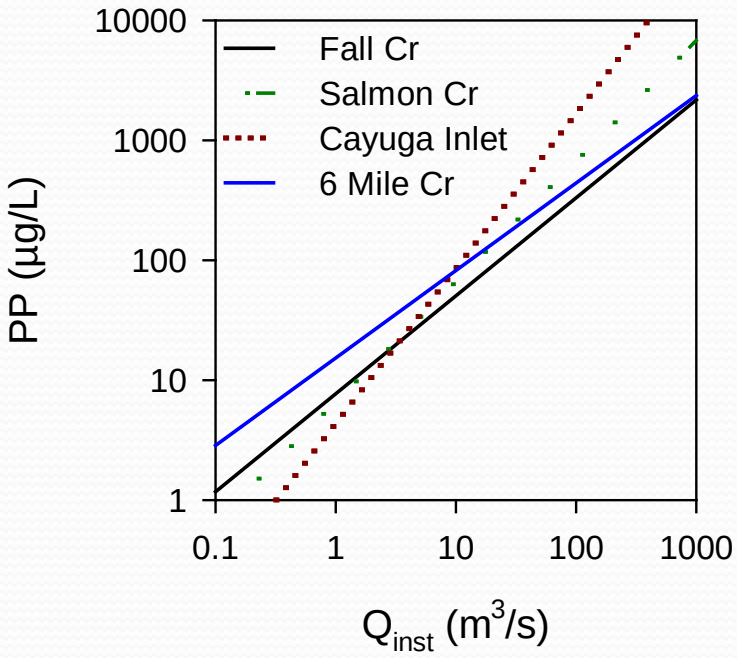
- April 12, 2013

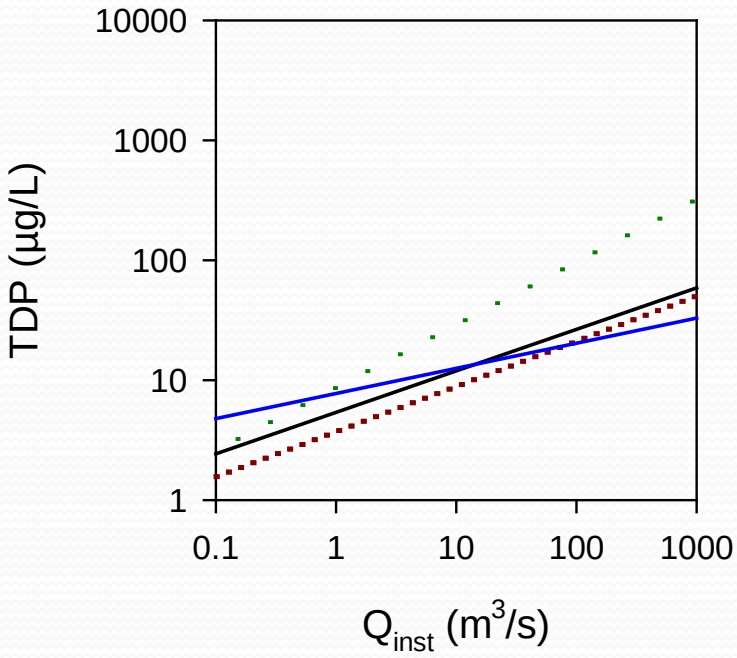
Results: Fall Creek Flow-Concentration Relationships



- mostly positive dependencies

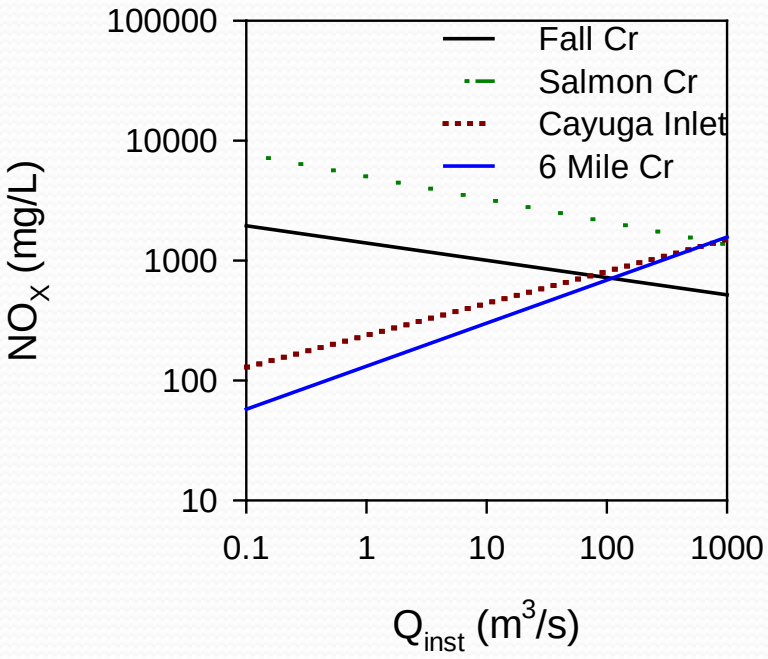
Results: Flow-Concentration Relationships

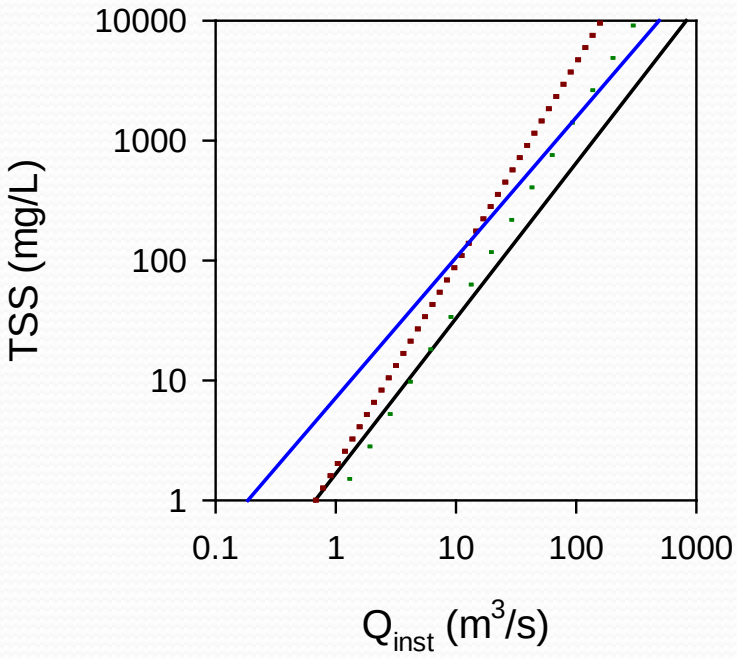




- tributary differences in low-flow concentrations (intercepts) and loading potential (slopes)

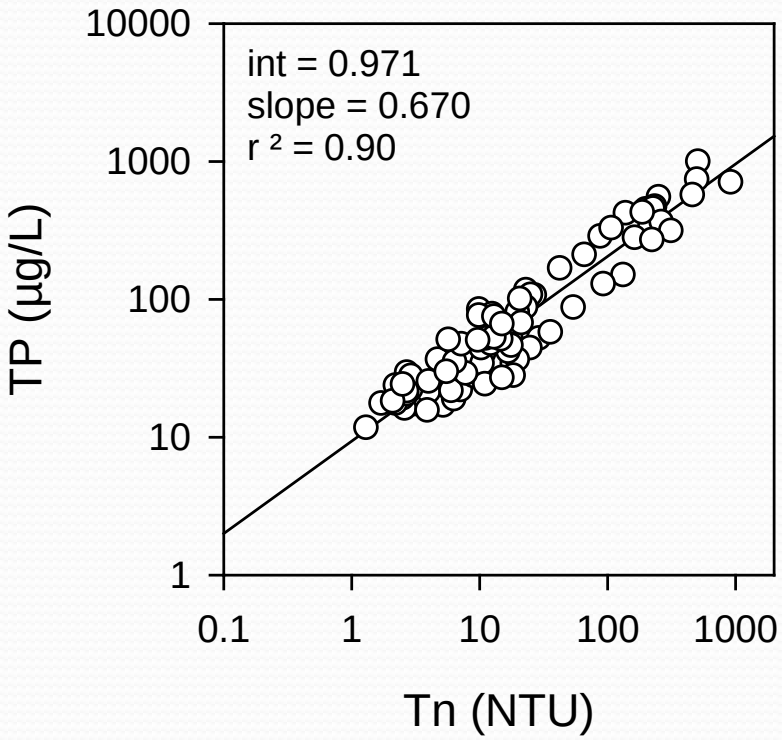
Results: Flow-Concentration Relationships

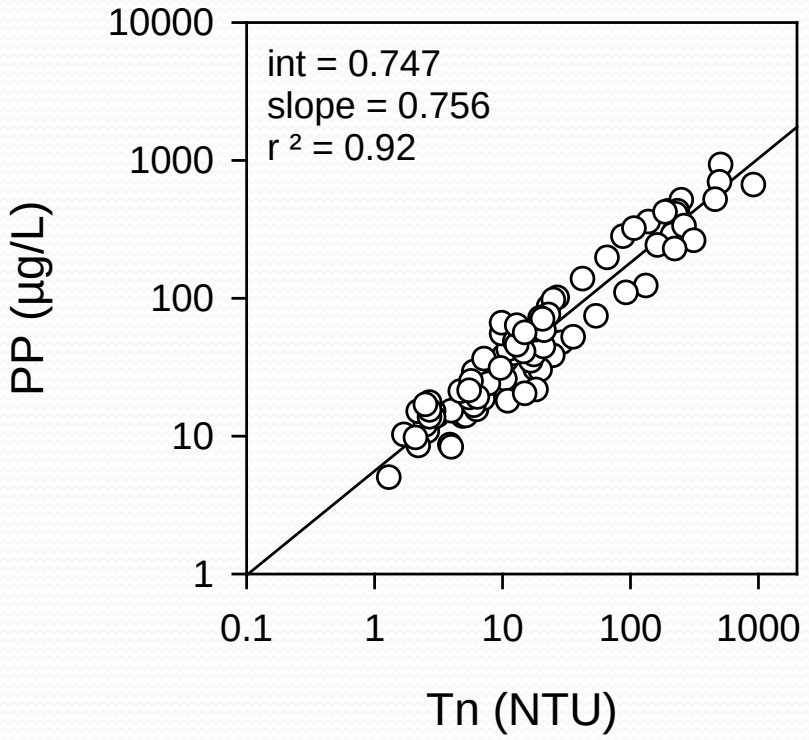




- tributary differences in low-flow concentrations (intercepts) and loading potential (slopes)

Results: Turbidity as a Predictor of TP, PP for Fall Creek



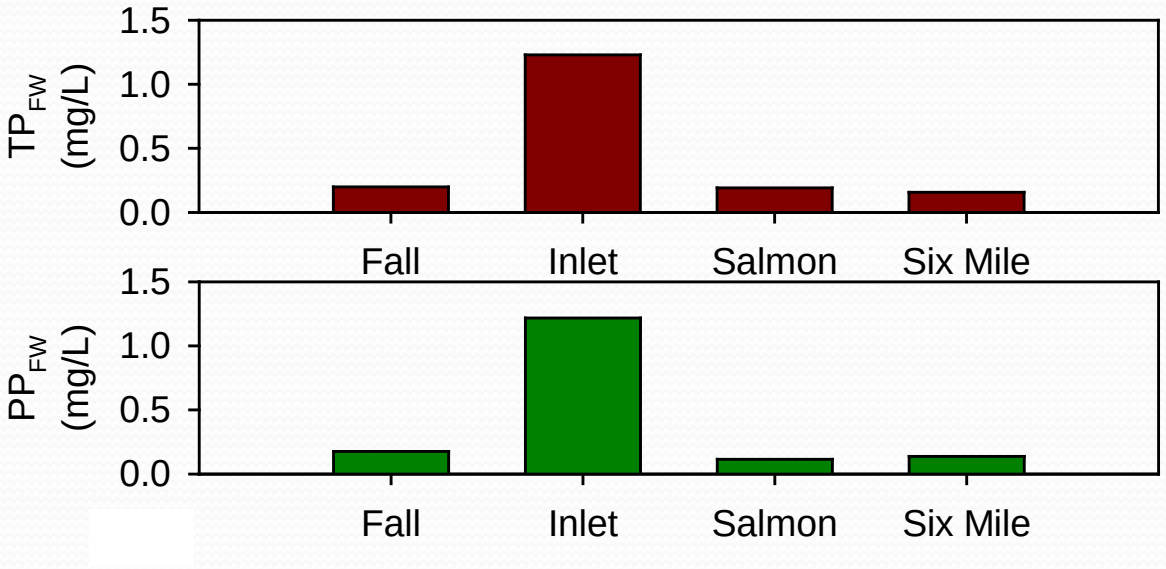


- turbidity often a much better predictor than flow for particulate constituents
  - r^2 Q-TP = 0.42
  - r^2 Q-PP = 0.46

Results:
Flow-Weighted Concentrations in 2013

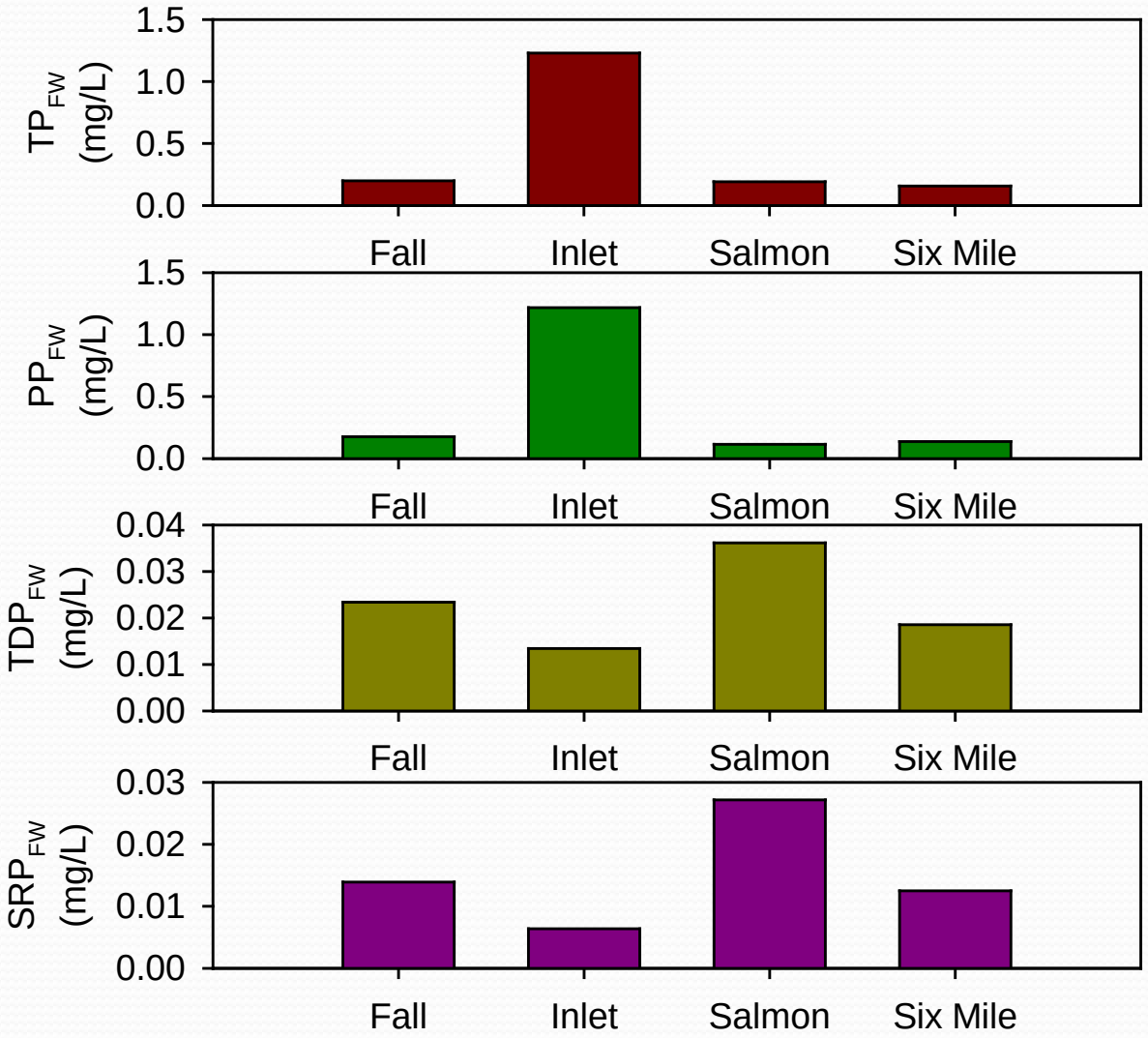
$$Conc_{FW} = \left(\sum Observed\ Load\right) \Big/ Volume\ Sampled$$

Results:
Flow-Weighted Concentrations in 2013



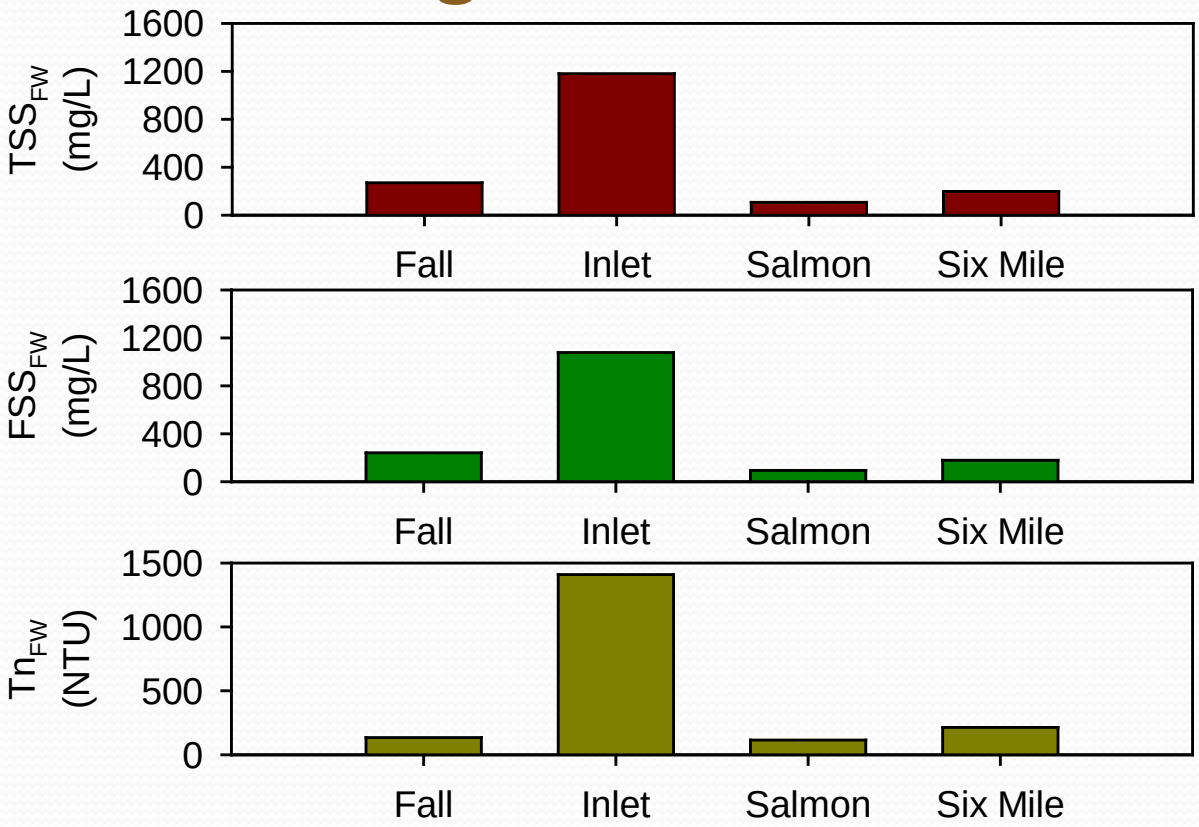
- Cayuga Inlet, highest in TP and PP

Results: Flow-Weighted Concentrations in 2013



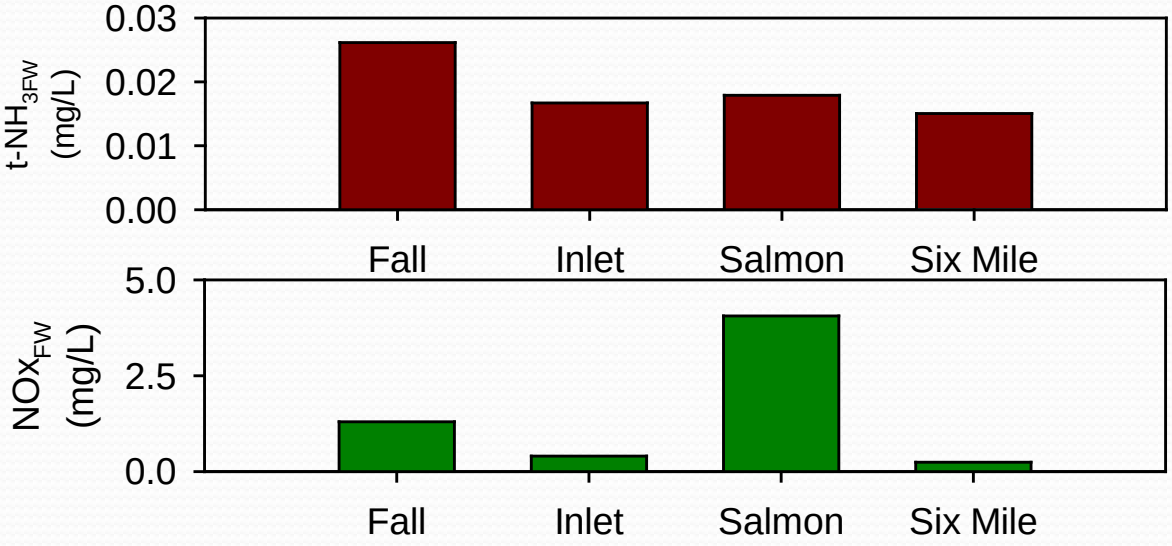
- Cayuga Inlet, highest in TP and PP
- Salmon Creek enriched in dissolved forms of P
  - ~ 75 % of TDP is SRP

Results:
Flow-Weighted Concentrations in 2013



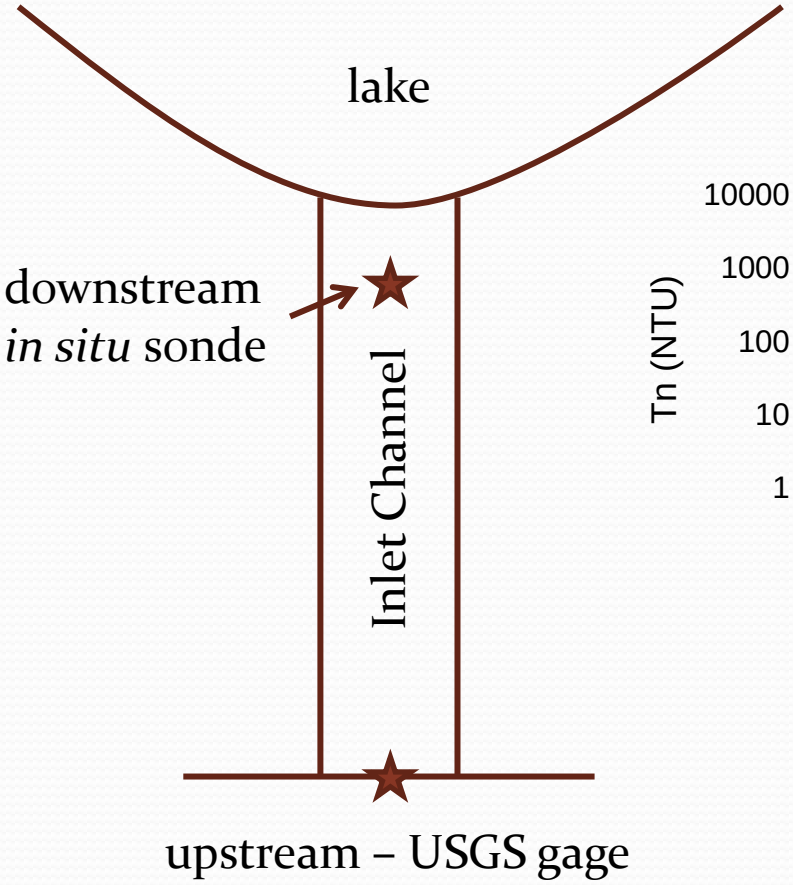
- Cayuga Inlet, highest in TSS
- High fraction of TSS is FSS

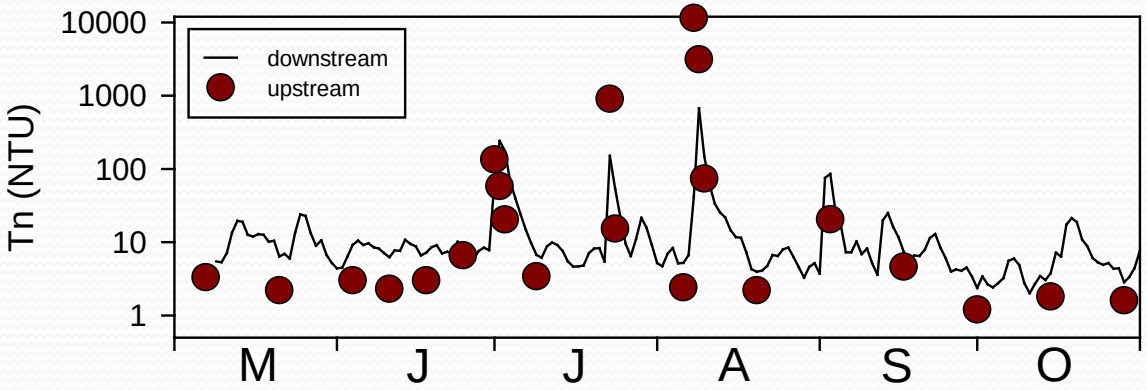
Results:
Flow-Weighted Concentrations in 2013



- Fall creek highest in t-NH3
- Salmon Creek extremely high in NOx
  - Fall Creek high as well

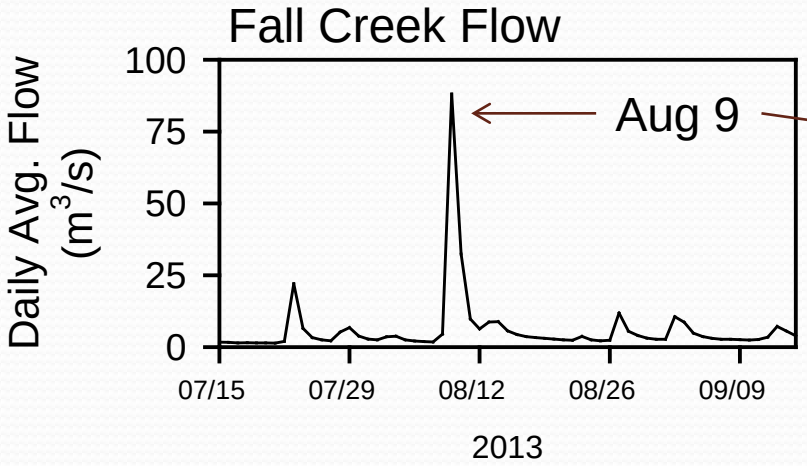
Results:
Cayuga Inlet Mouth v. Channel



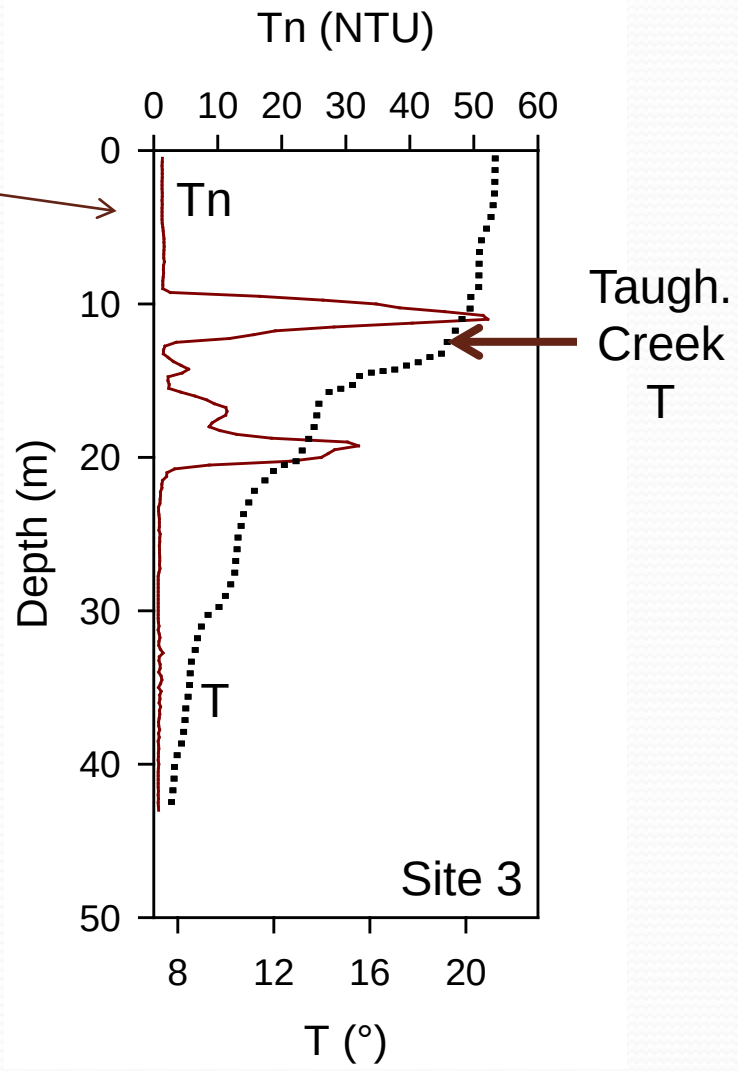


- source/sink dynamics of channel deposits?

Results: Evidence of Plunging



- Subsurface turbidity impacts at Site 3
- 0.7 km NW Taughannock Cr. mouth



Future Analysis

- More detailed statistical analysis
- Evaluate low-flow vs. high flow conditions
- Loading estimates
  - Flux Load Estimation software
    - utilizes flow-concentration relationships to generate daily load estimates
    - investigate event loading estimates from high intensity sampling during runoff events
- Unmonitored tributaries
  - under deliberation
  - interaction with T. Walters
  - watershed area ratios
  - selection of tributary for constituent pro-rating