Bacteria Trends Report

Informational Item

Technical Committee Meeting
February 7-8, 2017
Agenda Item #5

Background

- Bacteria data collected routinely as part of Contact Recreation Program
- Data uses:
  - Weekly reporting of conditions for recreation
  - Assess attainment of WQS (305b)
- Municipalities spending $Billions on Long Term Control Plans and Consent Decrees
- Are bacteria levels improving?

Bacteria Data Availability

- 1990's – Commission begins routine fecal coliform sampling
  - Weekly sampling in six largest CSO communities
  - May through October
- 2000 – Sampling sites added
  - Upstream, downtown, downstream
- 2009 - Sites reduced to two per CSO community
- 2013 – Sampling period extended to include April

Contact Recreation Sites

Study Objectives

- Evaluate observed trends in bacteria data set
  - Spatial (comparison across and within CSO communities)
  - Temporal (Are levels changing over time?)
  - Seasonal trends
    - Changes over contact recreation season
    - Relationship to flow and precipitation

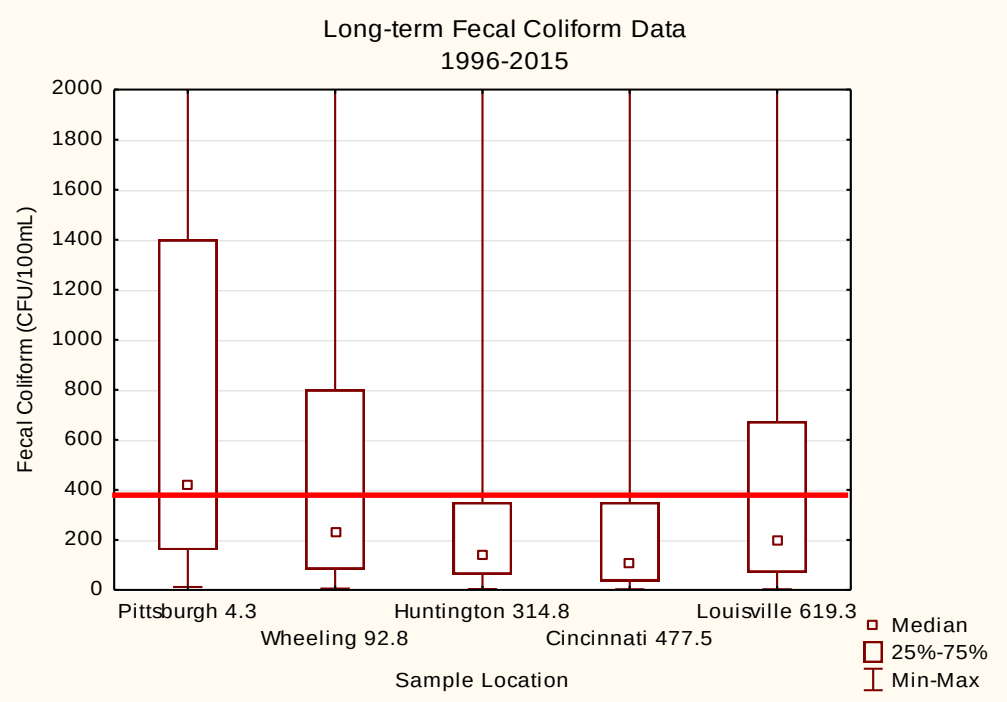
Assessment

- Evaluated based on concentration and frequency samples exceed water quality criteria.
- Spatial
  - Upstream/Downstream comparison
  - 2001 to 2015 (All 6 major CSO communities)
- Temporal
  - Rolling 5 Year aggregates
  - 1996 to 2015 (Excludes Evansville)
- Seasonal
  - Monthly comparison (May-Oct)
  - Precipitation – Grouped by precipitation ranges
  - Flow – Grouped by flow quintiles

Conclusions

Conclusions

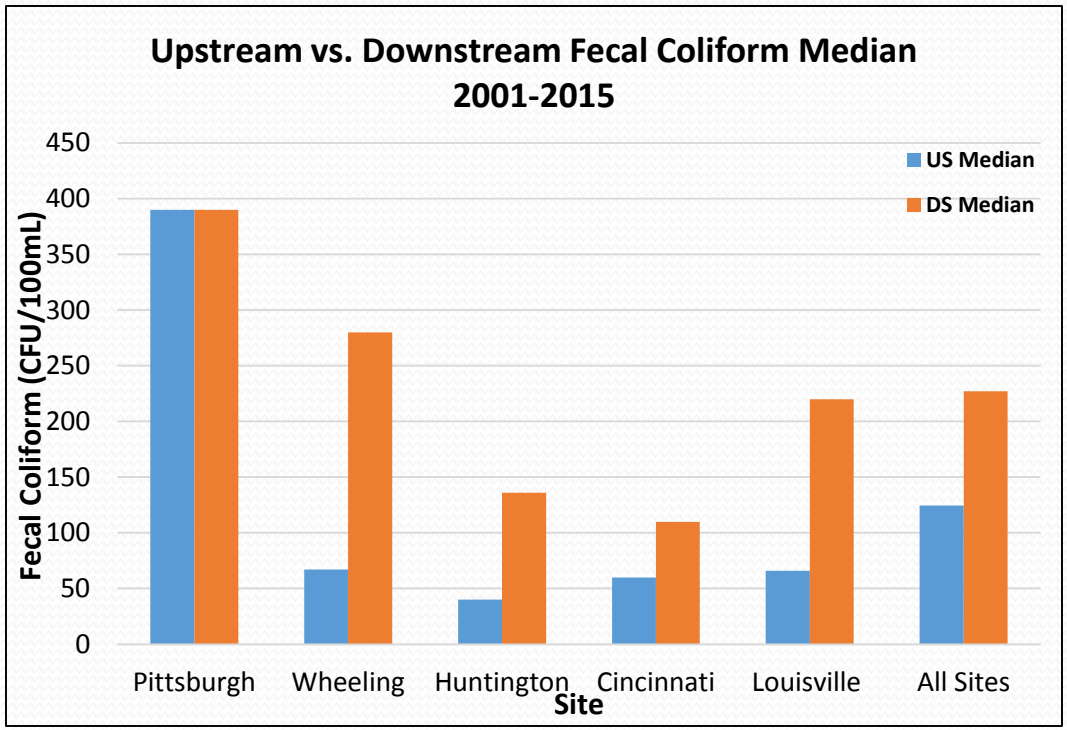
- Longitudinal
  - Lowest in Cincinnati/ Huntington
  - Highest levels in upper river



Rank	City	Median (cfu/100 ml)
T-1	Cincinnati	110
T-1	Huntington	136
3	Louisville	220
4	Wheeling	280
5	Pittsburgh	390

Conclusions

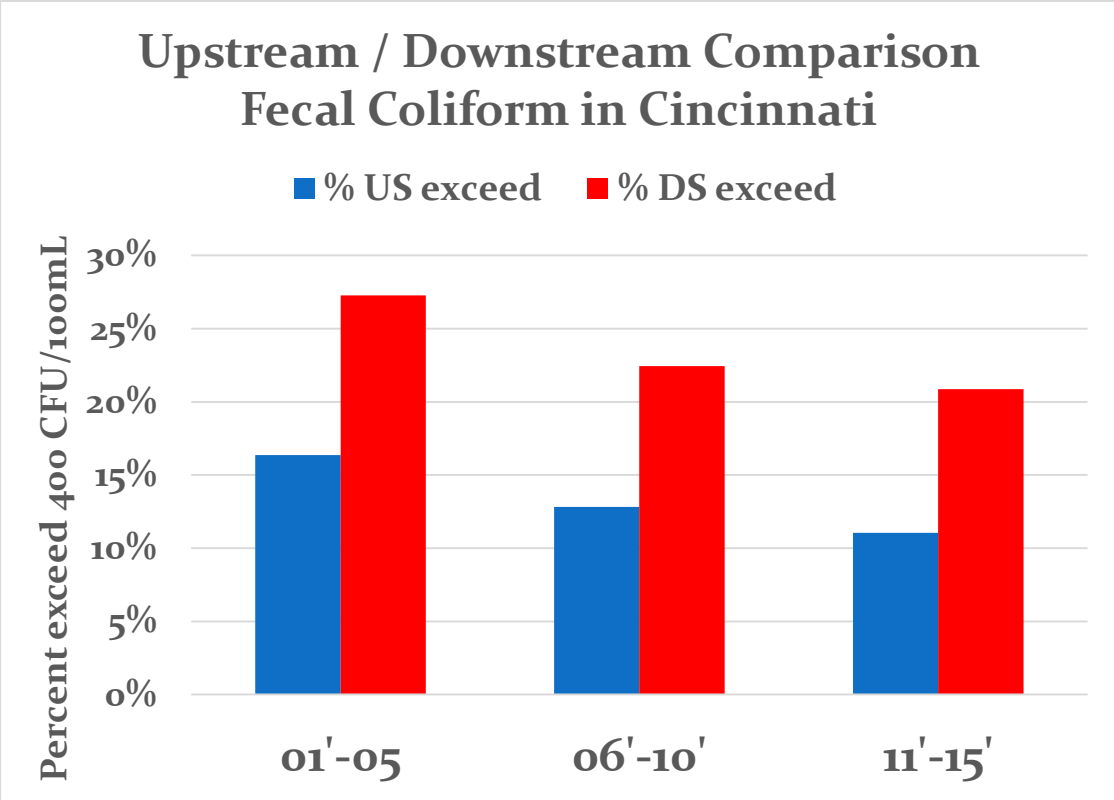
- Upstream / Downstream
  - Concentrations significantly greater at downstream site
    - Exception in Pittsburgh



	US Fecal Median	DS Fecal Median	Difference US vs DS	Exceed Criteria
Pittsburgh	390	390	0	52%
Wheeling	67	280	213	38%
Huntington	40	136	96	23%
Cincinnati	60	110	50	24%
Louisville	66	220	154	36%

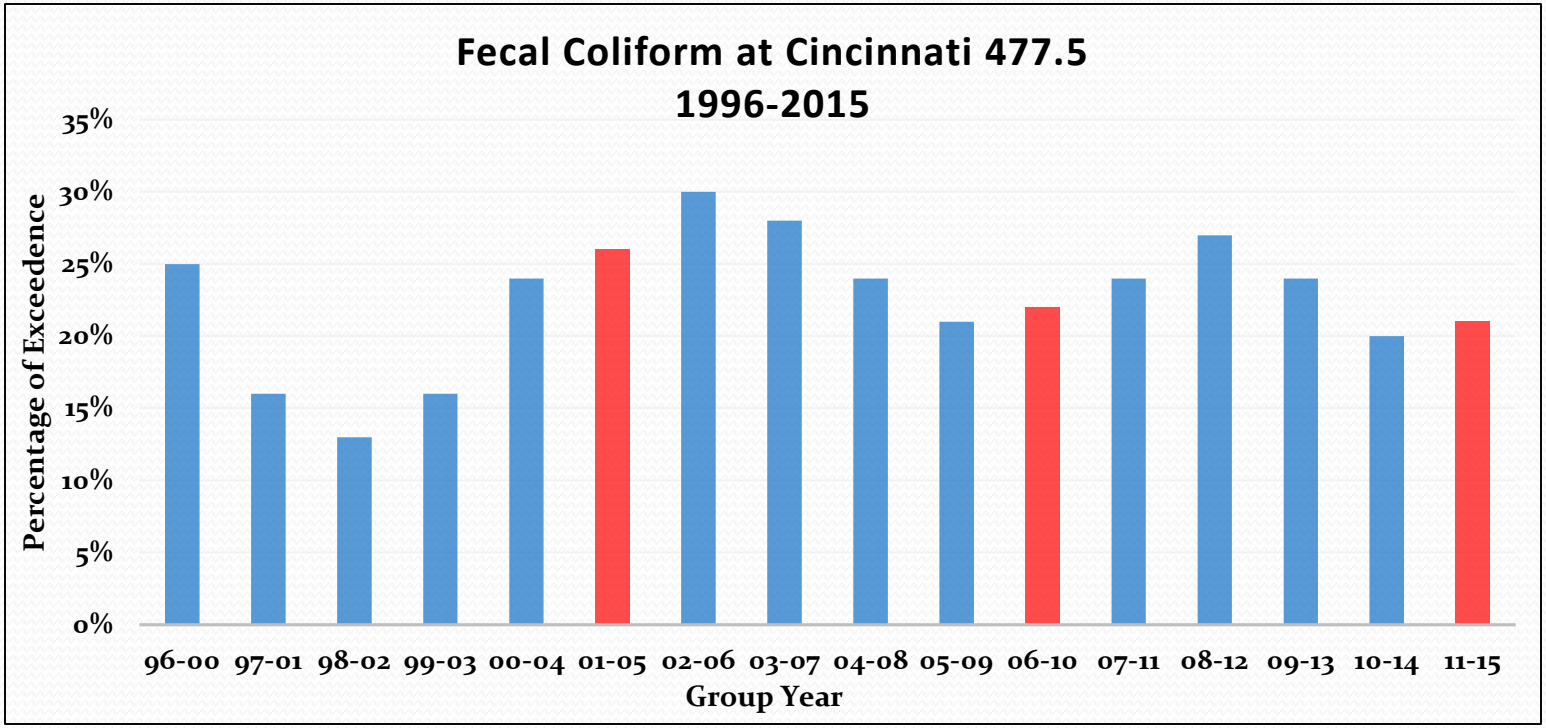
Conclusions (cont)

- Temporal
  - Previous presentation visually suggested improving trend over time



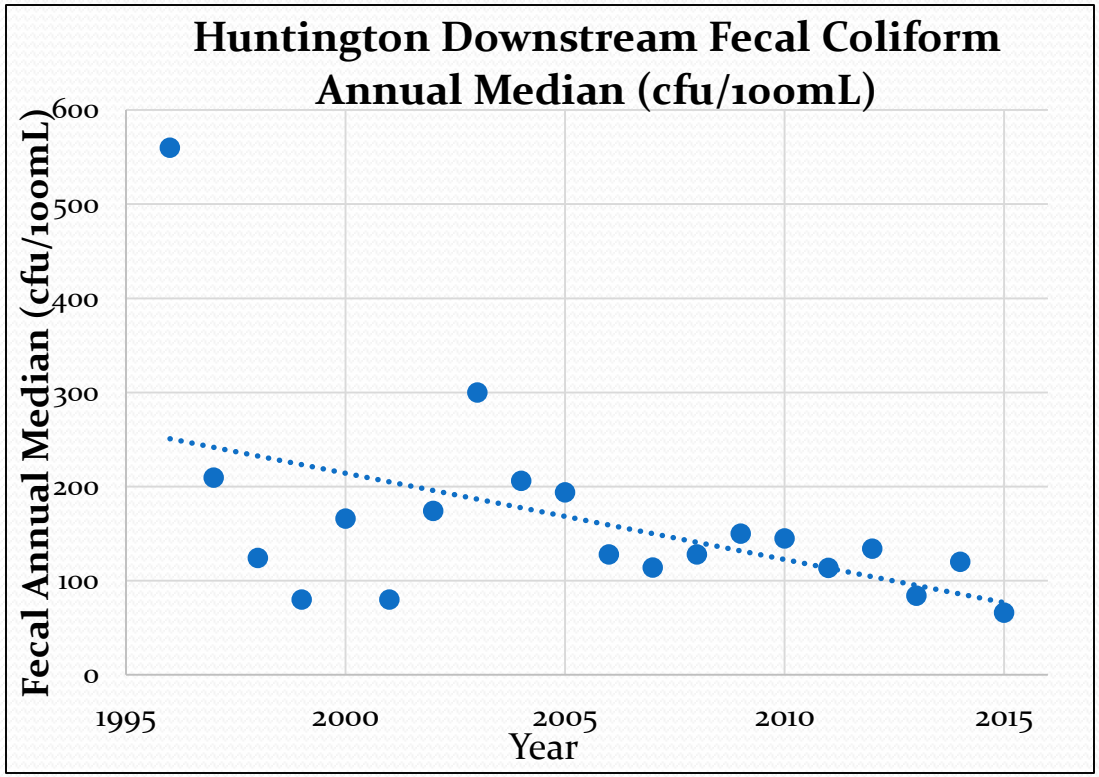
Conclusions (cont)

- Temporal
  - Rolling five-year plots gives a different perspective



Conclusions (cont)

- Temporal
  - Statistically significant decreasing trend found for Pittsburgh and Huntington

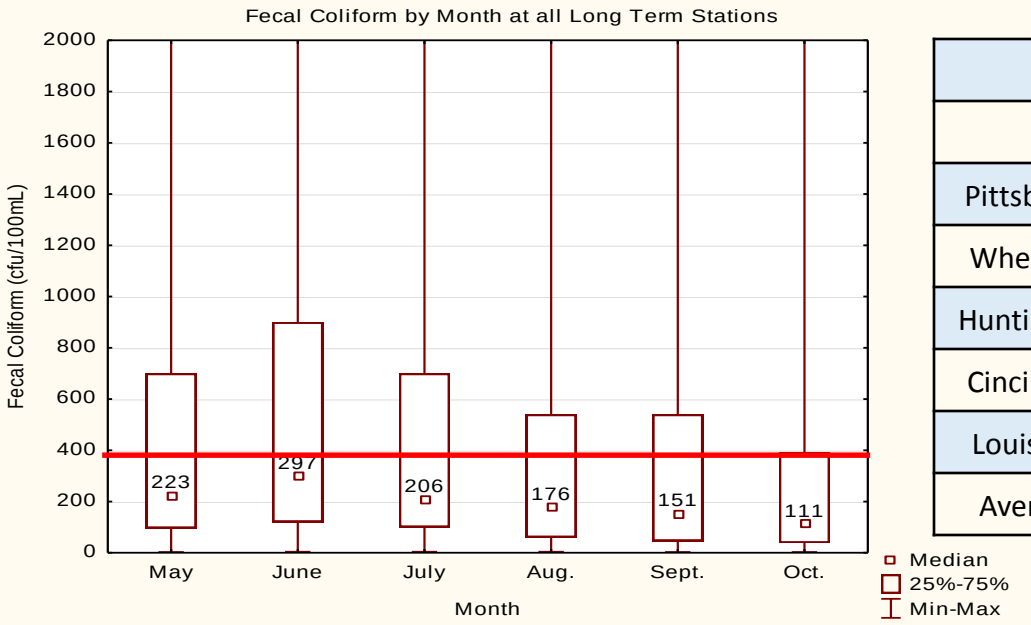


Downstream site	Spearman (R)	p-value
Pittsburgh	-0.489	0.029
Wheeling	0.277	0.238
Huntington	-0.460	0.041
Cincinnati	-0.136	0.567
Louisville	-0.322	0.166

Conclusions (cont)

- Monthly comparison
  - June exceedance rate 31-62%
  - October exceedance 13-37%
  - Pittsburgh exhibits different pattern

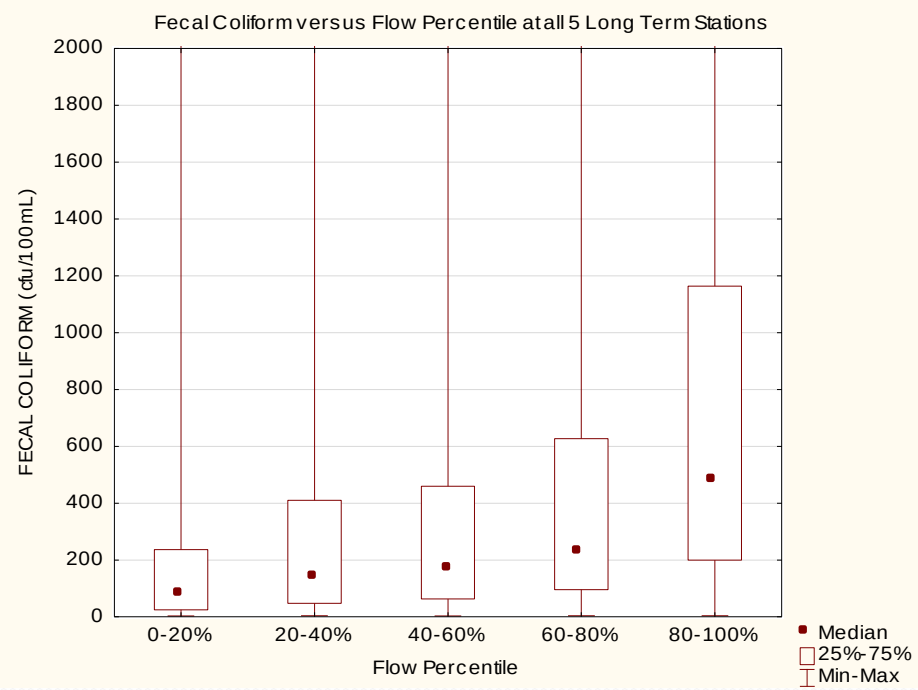
Rank	Month
1	June
2	May
3	July
T-4	August/September
6	October



Percentage Exceed						
	May	June	July	August	September	October
Pittsburgh	48	62	55	62	49	37
Wheeling	39	55	39	38	30	27
Huntington	32	31	28	15	16	13
Cincinnati	34	29	28	14	24	17
Louisville	41	42	31	34	37	32
Average	39	44	36	33	31	25

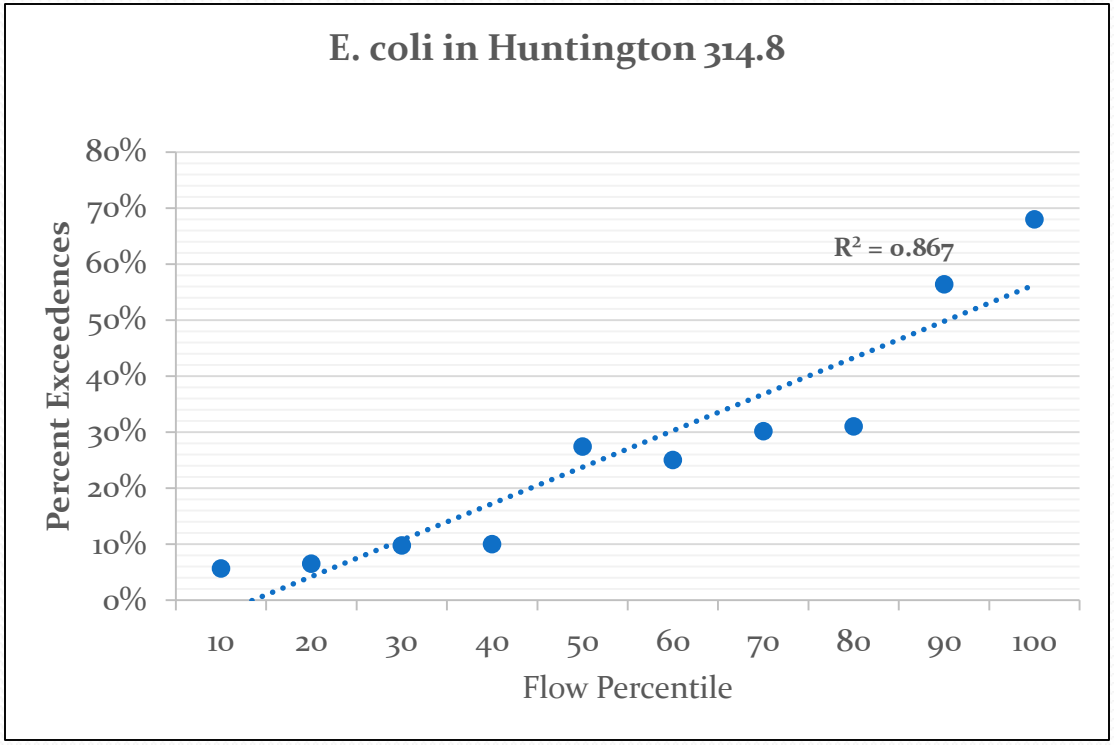
Conclusions (cont)

- Flow
  - Median concentrations steadily increase with flow
  - Variability also increases with flow



Conclusions (cont)

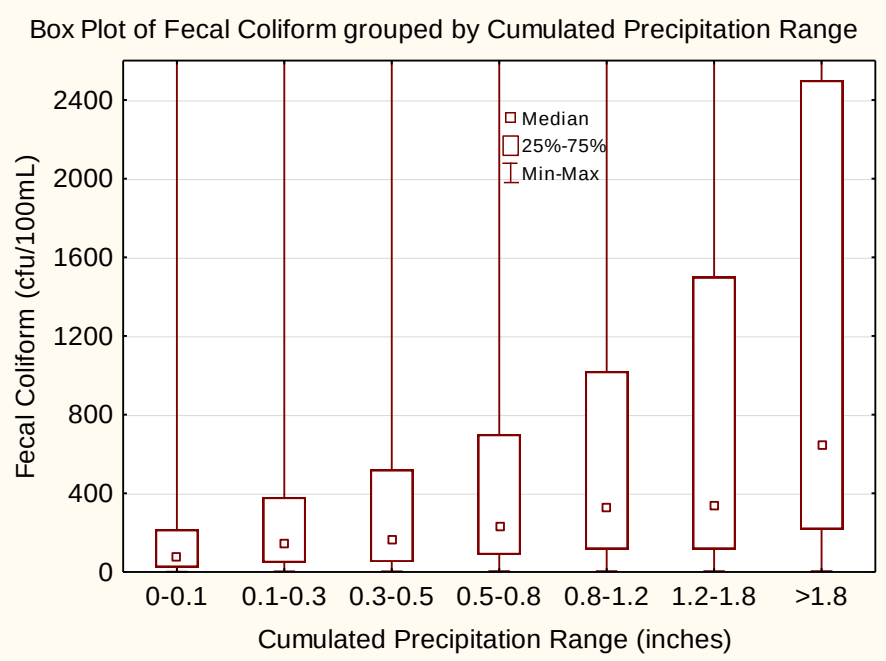
- Flow
  - Significant increasing trend with flow
    - Concentration and percentage of exceedances (Fecal and E. coli)



Site Name	R^2 *E. coli*	p-value
Huntington	0.867	0.000003
Wheeling	0.814	0.000004
Cincinnati	0.767	0.000077
Pittsburgh	0.746	0.000184
Evansville	0.707	0.000200
Louisville	0.667	0.000621

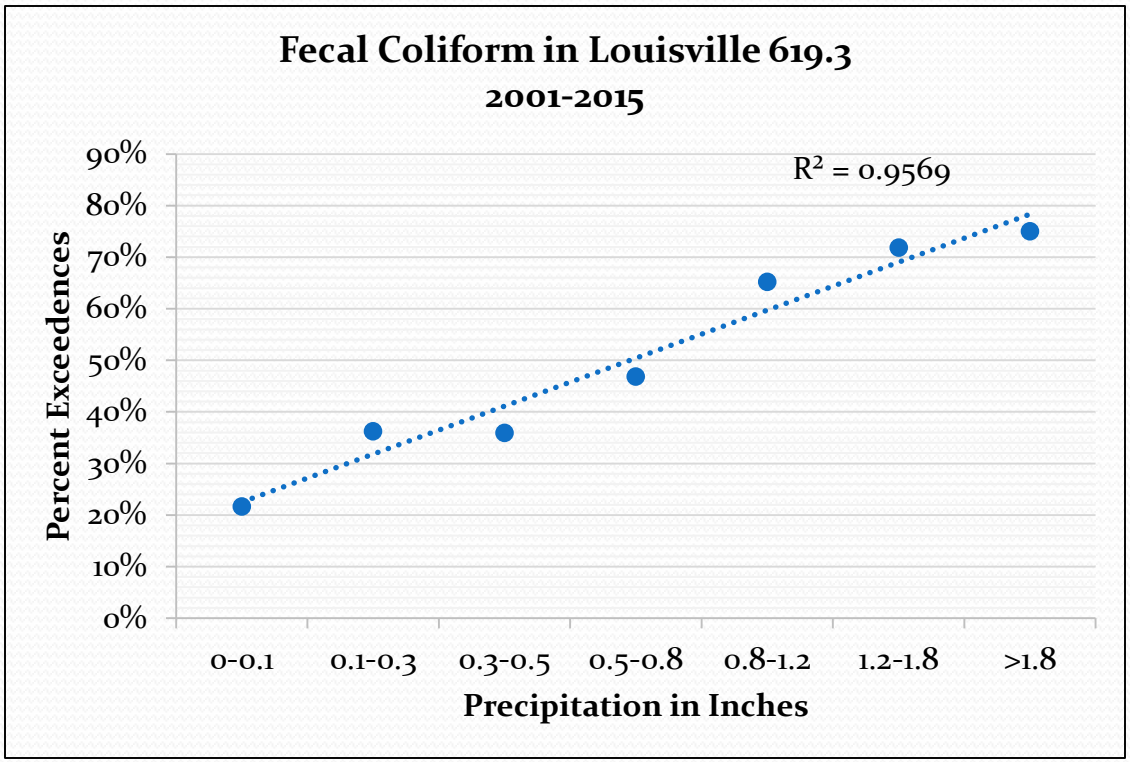
Conclusions (cont)

- Precipitation
  - Median concentrations steadily increase with rainfall
  - Variability also increases with rainfall



Conclusions (cont)

- Precipitation
  - Significant increasing trend
    - Concentration and percentage of exceedances (Fecal and E. coli)



Site Name	R^2 value	p value
LOUISVILLE	0.9569	0.0001
CINCINNATI	0.9423	0.0003
EVANSVILLE	0.9230	0.0006
HUNTINGTON	0.9152	0.0007
PITTSBURGH	0.8926	0.0013
WHEELING	0.7960	0.0069

Questions?