



Sensitivity of Trend Estimates to Sampling Frequency and Collection of High-Flow Samples

Hank Johnson

Jennifer Murphy

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Water-Quality Trends in Streams of the United States

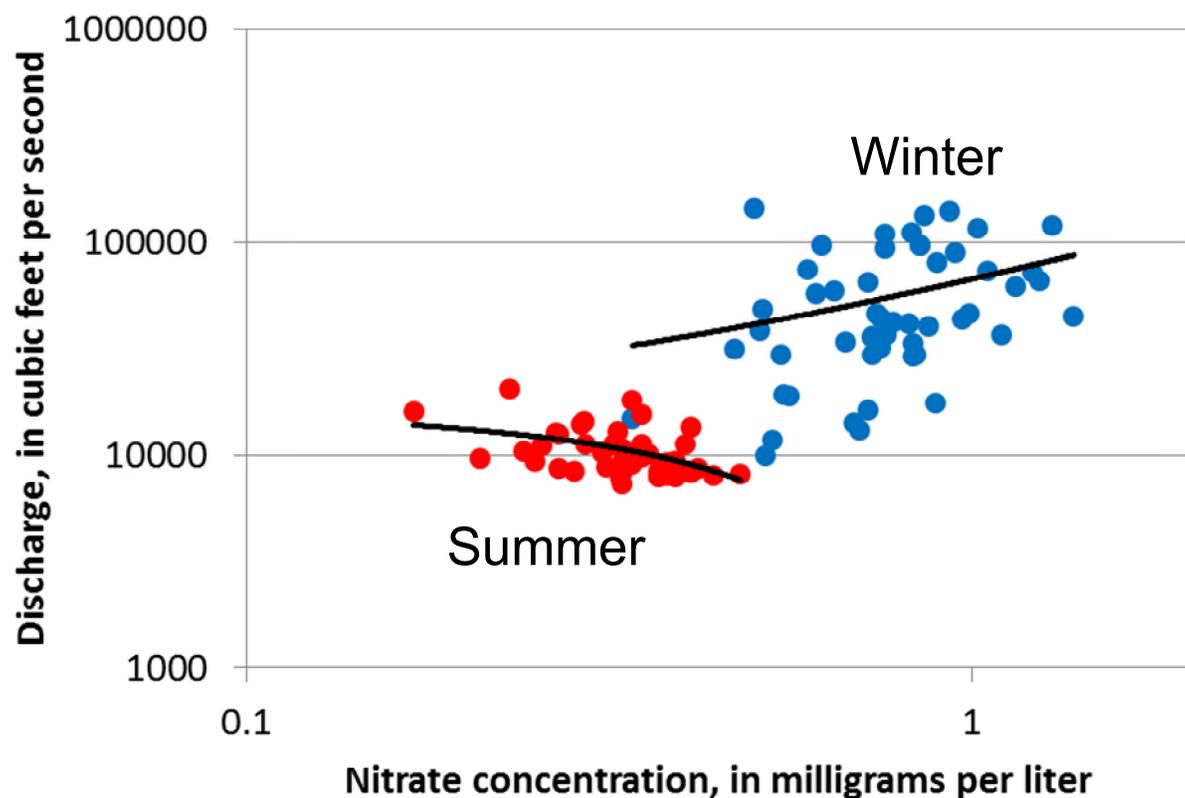
- **NAWQA project**
- **Using data from USGS and other public agencies**
- **Using WRTDS to model trends in concentration and load**

WRTDS Model – Important Concepts

- Regression model: Q, T, seasonality
- Samples are weighted on time, discharge, and season
- “Windowing” used to assign weights

WRTDS Model – Important Concepts

Example:
Seasonal differences in the concentration-discharge relation



Data Source: USGS National Water Information System
Willamette River at Portland, Oregon (14211720)

The data used in our trend study must have good coverage in time, discharge, and season

The time dimension is easy to address

What about discharge and season? What constitutes “good enough”?

Sensitivity Testing

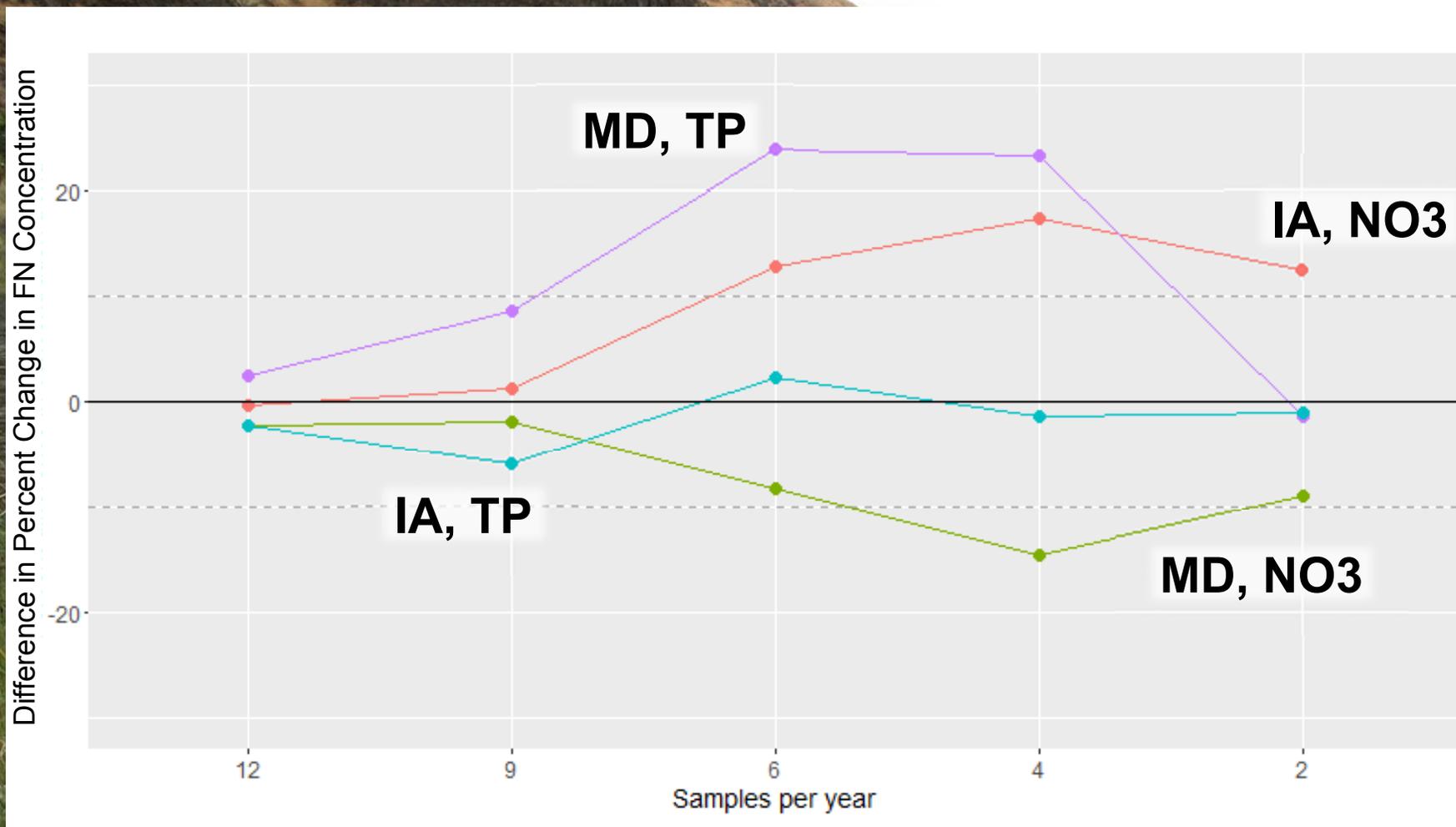
- Select sites with long, rich data set
- Downsample the data
- Run WRTDS
- Evaluate Trends

Sensitivity to Sampling Frequency

2 sites (MD, IA):

- about 25 samples per year
- 30+ years of record
- nitrate, total phosphorus
- randomly downsampled such that the subsets contained 12, 9, 6, 4, and 2 samples/year

Sensitivity to Sampling Frequency

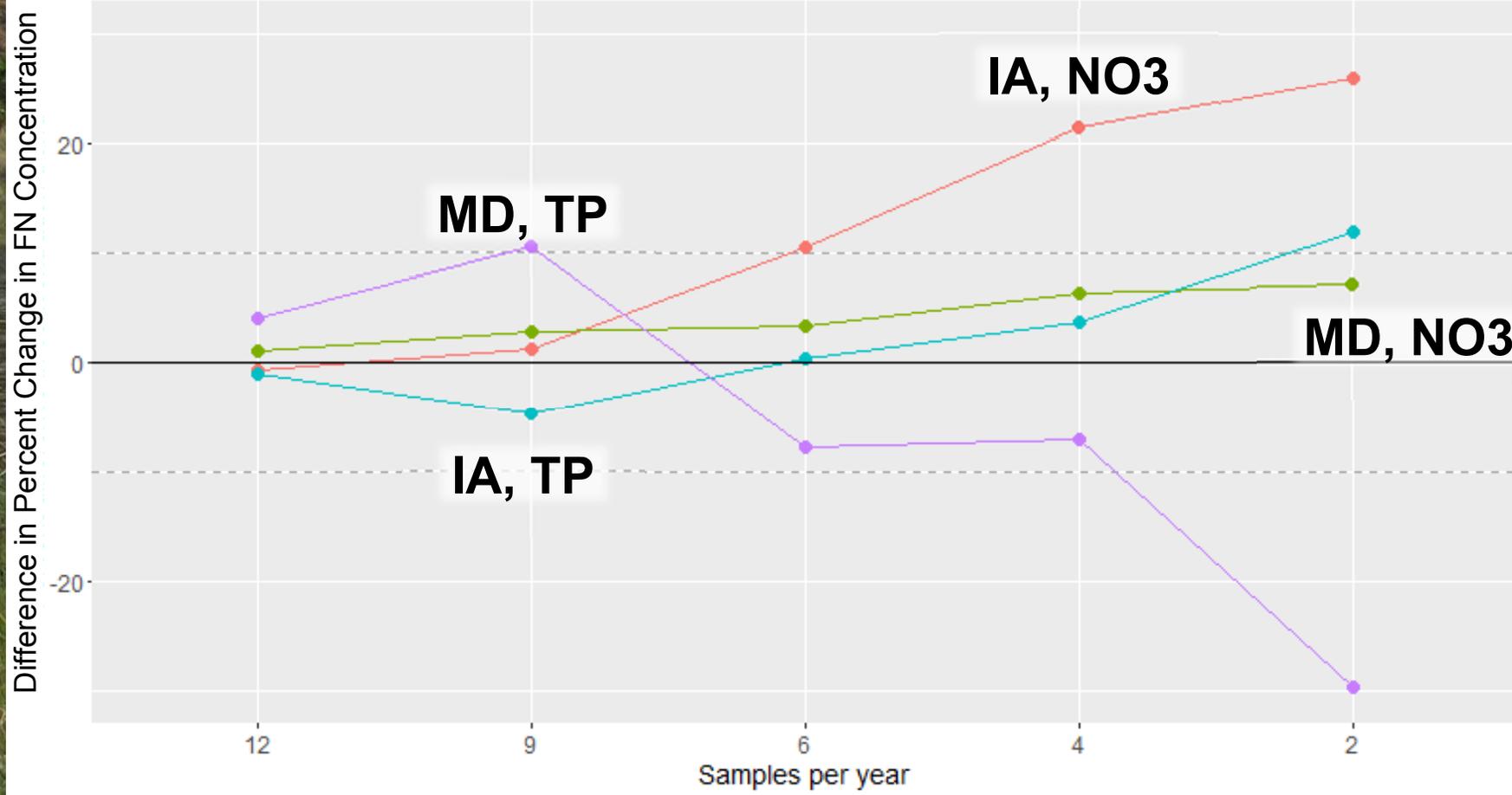


Provisional data, subject to revision

Trend Period: 1982-2012

- Error increases as n per year decreases
- Small change in trend bias direction for TP

Sensitivity to Sampling Frequency



Provisional data, subject to revision

Trend Period: 2002-2012

- Error increases as n per year decreases
- Substantial change in trend bias direction for TP at both sites



Sensitivity to Sampling Frequency

**Errors due to downsampling
are compounded by loss of
high-flow samples**

**More sophisticated analysis
could help separate effects**

Sensitivity to High-Flow Samples

2 sites (VA, NE):

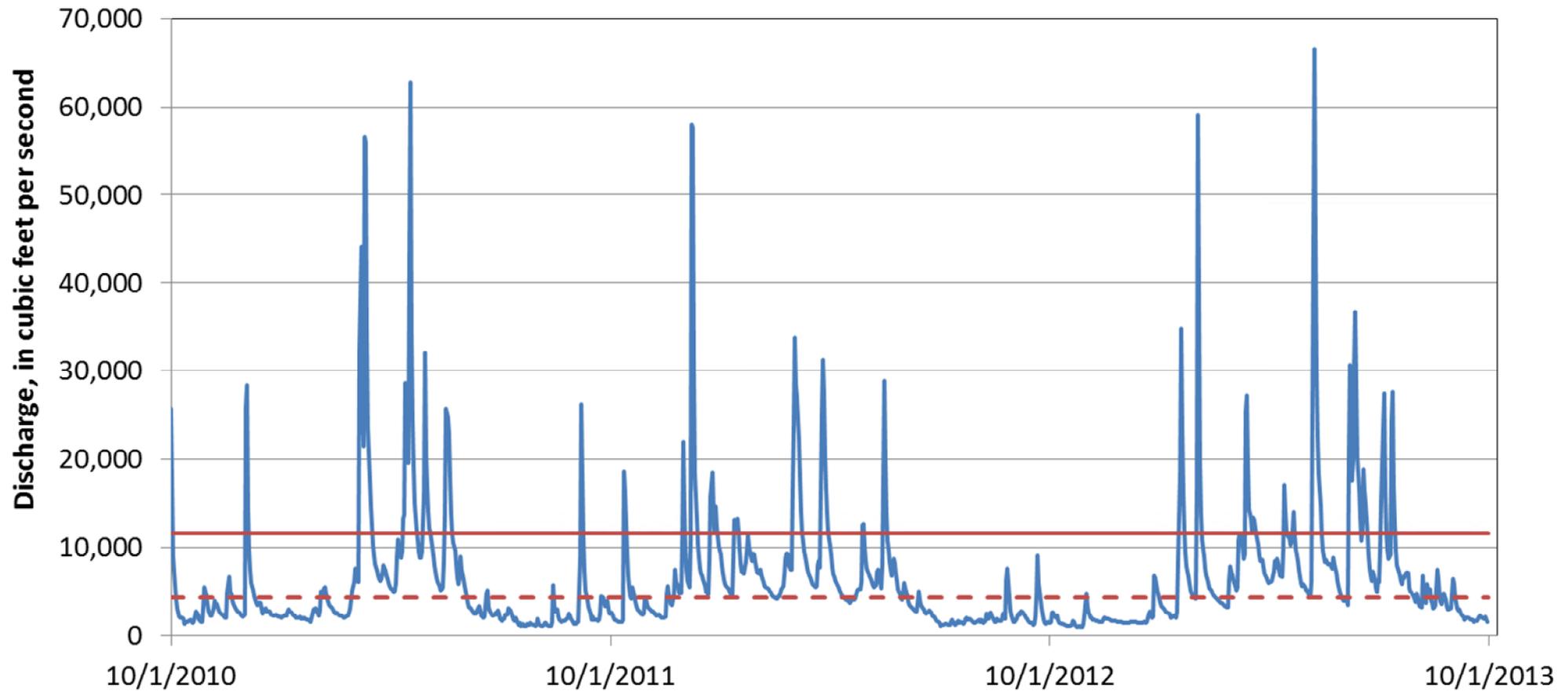
- long-term data collection
- high percentage of high-flow samples
- nitrate, total phosphorus
- downsample data set to contain 22, 18, 14, 10, 6, and 2 percent high-flow samples

Sensitivity to High-Flow Samples

High Flow, Defined

- 85th percentile of monthly flows for a 10 year period
 - 1972-1981, 1982-1991, 1992-2001, 2002-2012
- accounts for seasonal and long-term differences in flow

Sensitivity to High-Flow Samples



Data Source: USGS National Water Information System
James River at Cartersville, Virginia (02035000)

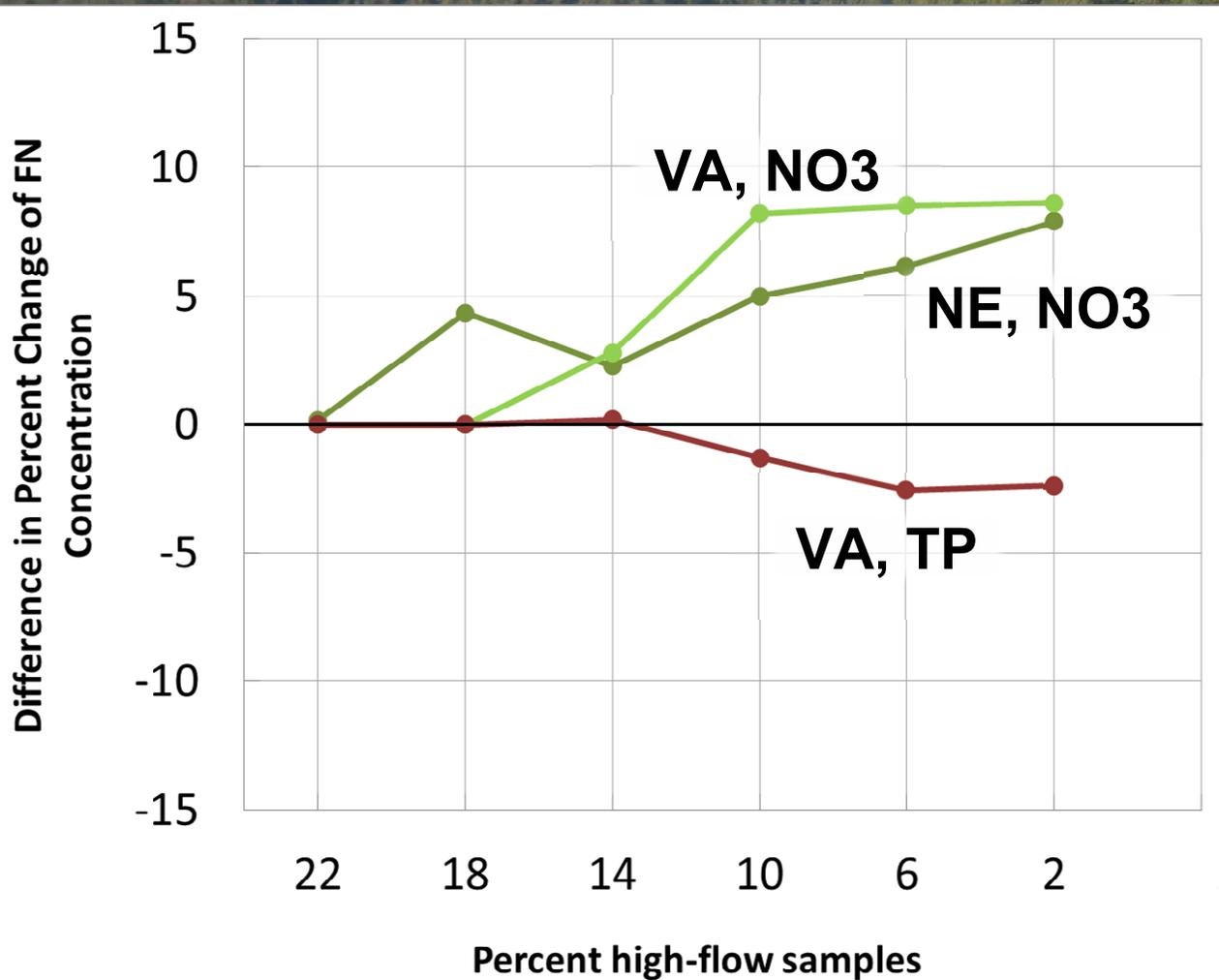
Example:

Fall storm peaks < 85th percentile

Spring baseflow > 50th percentile



Sensitivity to High-Flow Samples

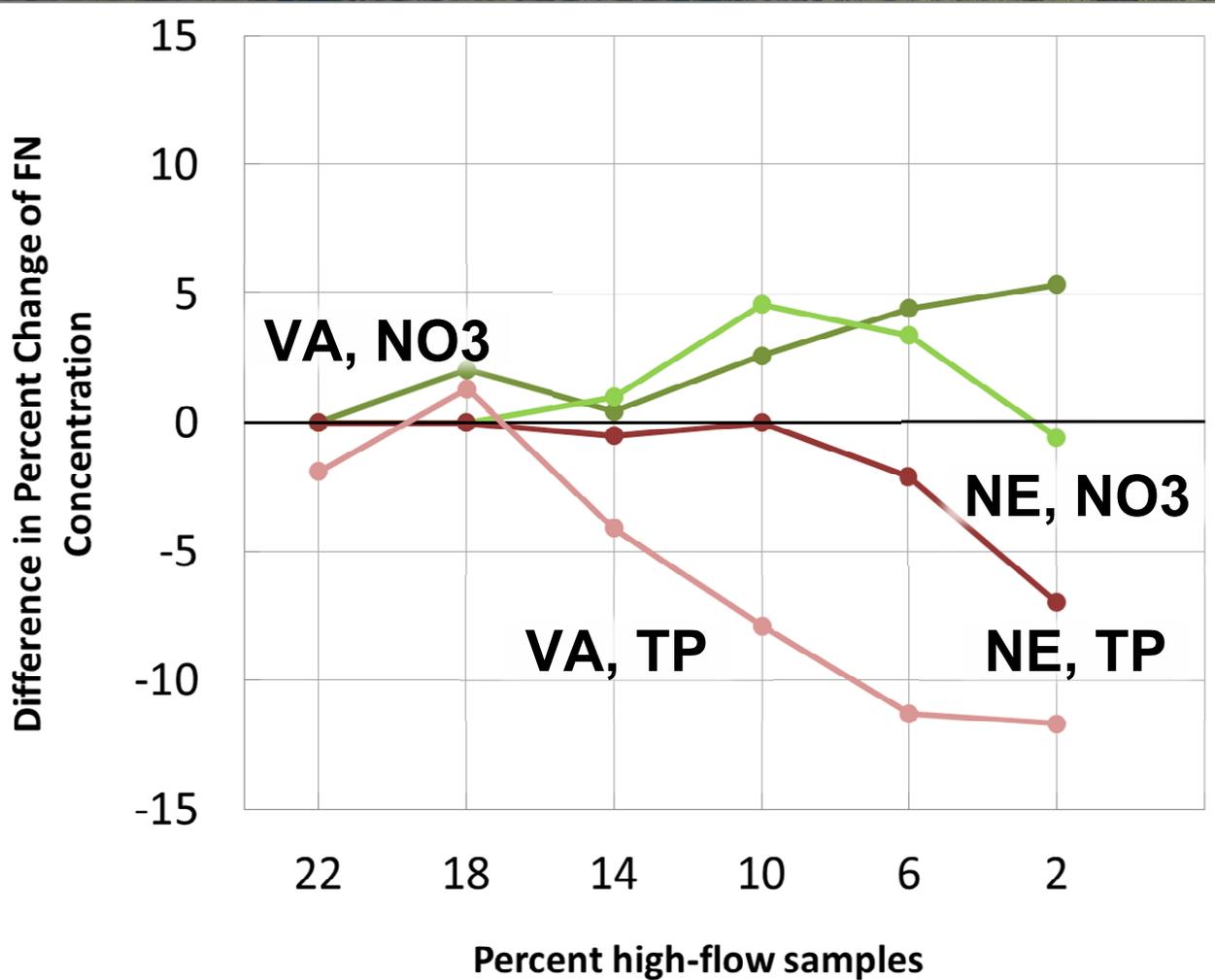


Trend Period: 1982-2012

- Trend increasingly inaccurate as # HF samples decreases
- For these 2 sites:
 - NO3 trend overpredicted
 - TP trend underpredicted
- Small change in trend bias direction for VA, TP

Provisional data, subject to revision

Sensitivity to High-Flow Samples



Trend Period: 2002-2012

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- For these 2 sites:
 - NO3 trend overpredicted
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Provisional data, subject to revision

Time/Season:

Quarterly samples in first and last two years of trend period AND

Quarterly samples in 70% of intervening years AND

Discharge:

At least 10% high flow in all trend decades AND

At least 14% high flow in half of trend decades



- Collaborator:
- Data Management:
- Trends Team Lead:
- Funding:

Jennifer Murphy
Gretchen Oelsner
Lori Sprague
USGS NAWQA project

For questions and more information:

Hank Johnson
hjohnson@usgs.gov





Sensitivity to High-Flow Samples

Yakima River at Kiona, WA(12510500): Total Phosphorus

