



# Water Quality Monitoring

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Talk to your state  
monitoring  
colleagues

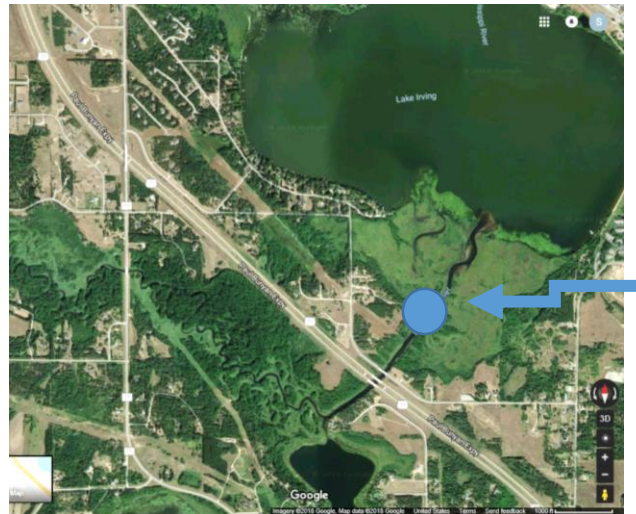
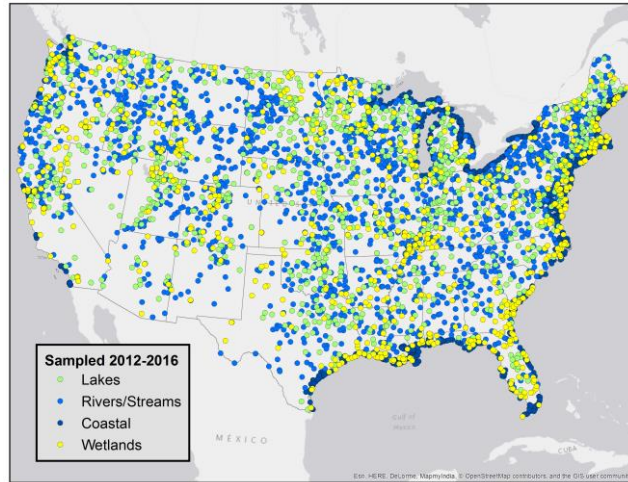
# Elements of a State Water Monitoring and Assessment Program

- Monitoring Program Strategy
- ***Monitoring Objectives***
- ***Monitoring Design***
- ***Core and Supplemental Indicators***
- Quality Assurance
- Data Management
- Data Analysis/Assessment
- Reporting
- Programmatic Evaluation
- General Support and Infrastructure Planning

Knowing your  
questions is  
essential

Why we  
monitor: to  
answer  
questions at  
multiple scales

- What extent of waters support CWA goals, WQS, etc?
- What is causing water quality problems (e.g., stressors, pollutants)?
- Is water quality changing over time?
- Where are the problem areas and areas needing protection?
- How effective are clean water projects and programs?



## Monitoring Design

- Cost effective support of monitoring objectives / decision needs, e.g. combination of:
  - Statistical (probability) survey to assess broad population of water resources
    - Unbiased, representative condition estimates
    - Scaled to management questions and resources
    - Track changes over time, program wide effectiveness
    - Provide context around targeted, site-specific results
  - Targeted to address local issues, assess site-specific conditions
    - Intentional selection of a specific waterbody/location to address local issue
    - Investigate known or suspected water quality problems, pollution sources
    - Evaluate compliance with a discharge permit, effectiveness of individual action
    - Track long term change at a project site

# Implementation Approaches

- Fixed sites – can be probability or targeted, for example
  - Fixed sites targeted at pour point of HUC 8 to track flow and flux of nutrients
  - Fixed sites randomly distributed across lakes to track changes in trophic condition
- Rotating Basin – can include probability and targeted
- Frequency and duration of sampling activities include
  - Seasonal aimed at recreational activities at high use waters
  - Annual index period for biological integrity
  - Monthly, daily, time series based on decision needs



# Core and Supplemental Indicators

- Core indicators appropriate for assessing attainment with applicable uses
  - Aquatic life – biology, basic chemistry
  - Recreation – driven by public use/exposure
  - Public water supply – driven by source water
  - Fish and shellfish consumption - mercury
- Supplemental indicators
  - Specific to watershed and potential sources
  - Selected to follow up on biological impairment





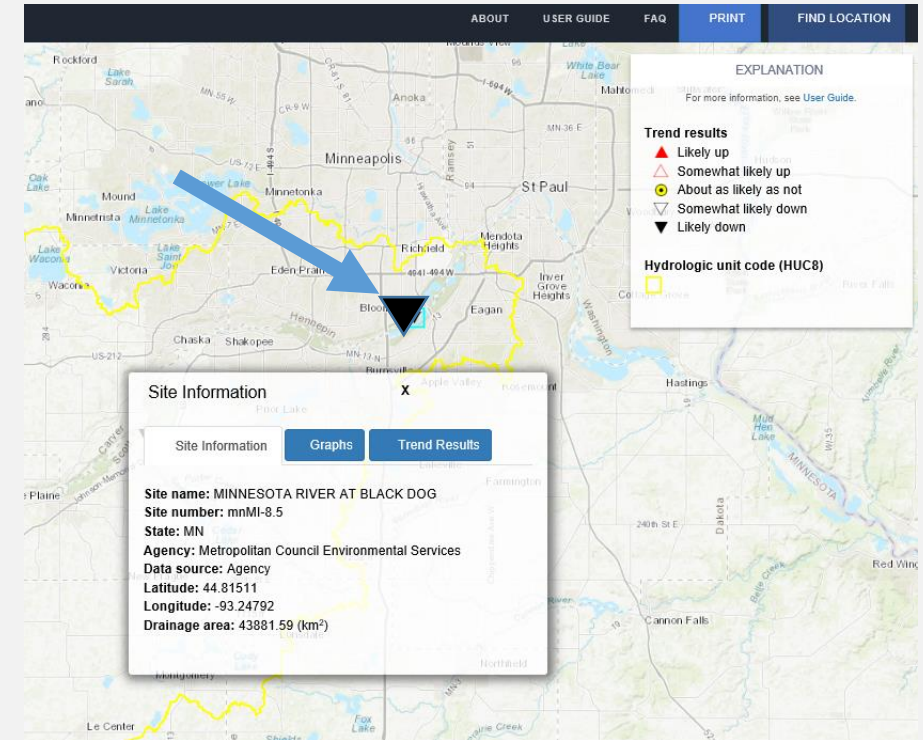
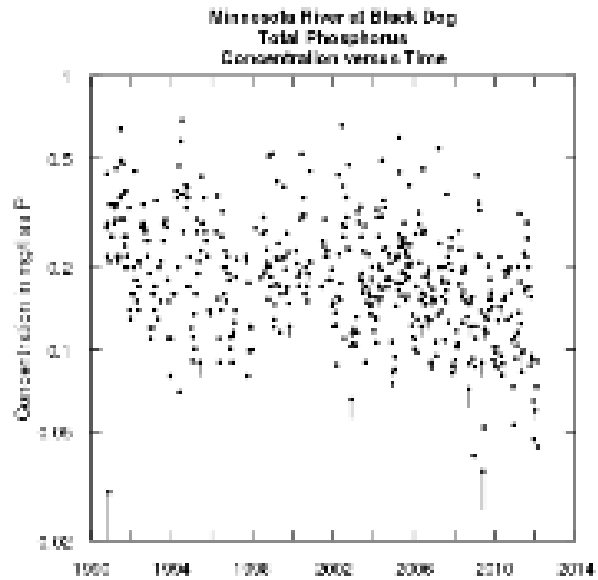
## Examples of answering questions with targeted and probability data

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- Different information is obtained from these approaches
  - What are phosphorus conditions at my site and how are they changing?
  - Is that representative of other waters in the area/state/nation?
  - What are conditions nationally or regionally?

# USGS: Water-Quality in the Nation's Streams and Rivers – Current Conditions and Long-Term Trends

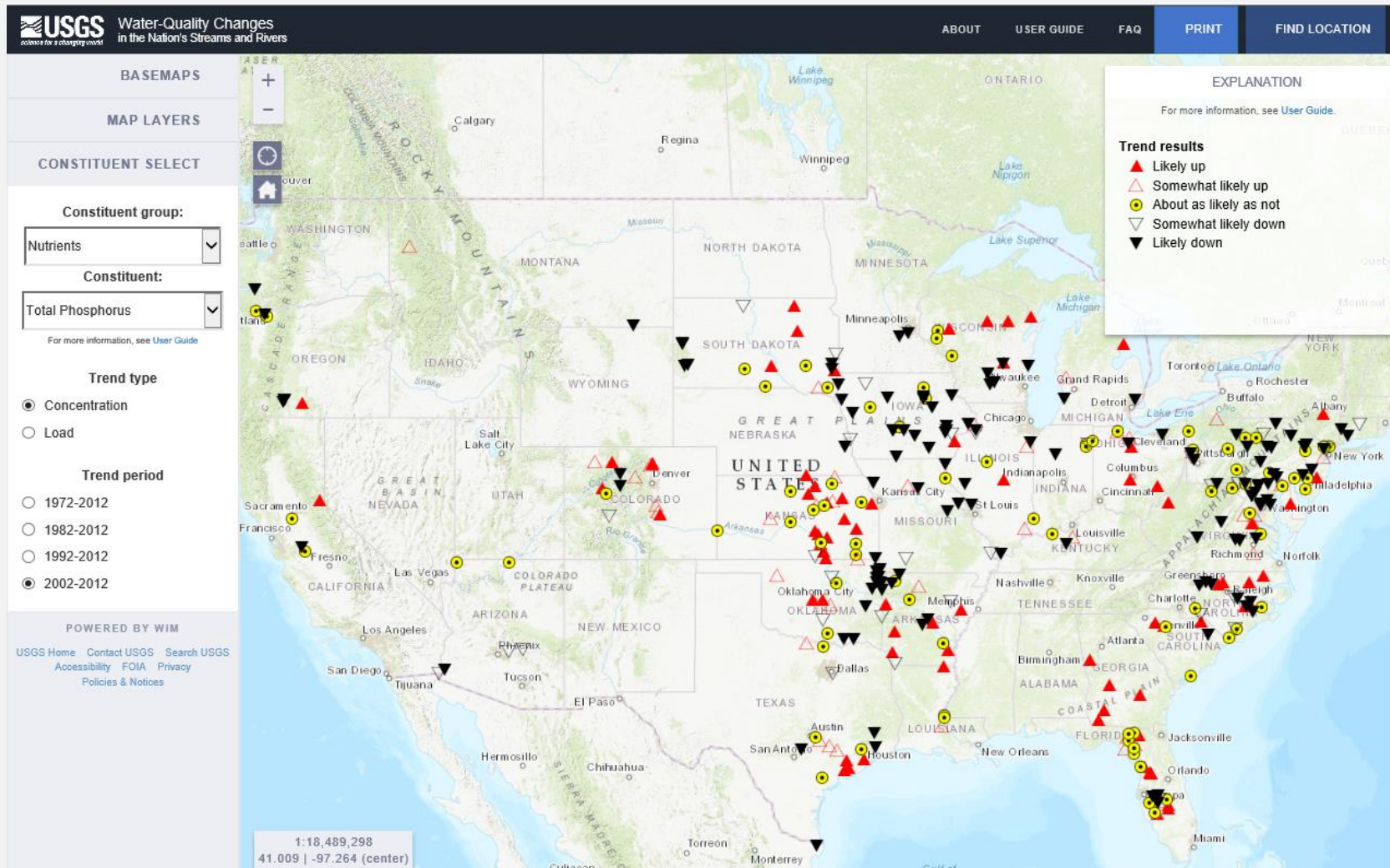
## Monitoring Data



At my site: trend is likely down (improvement)  
Is that similar to other waters?

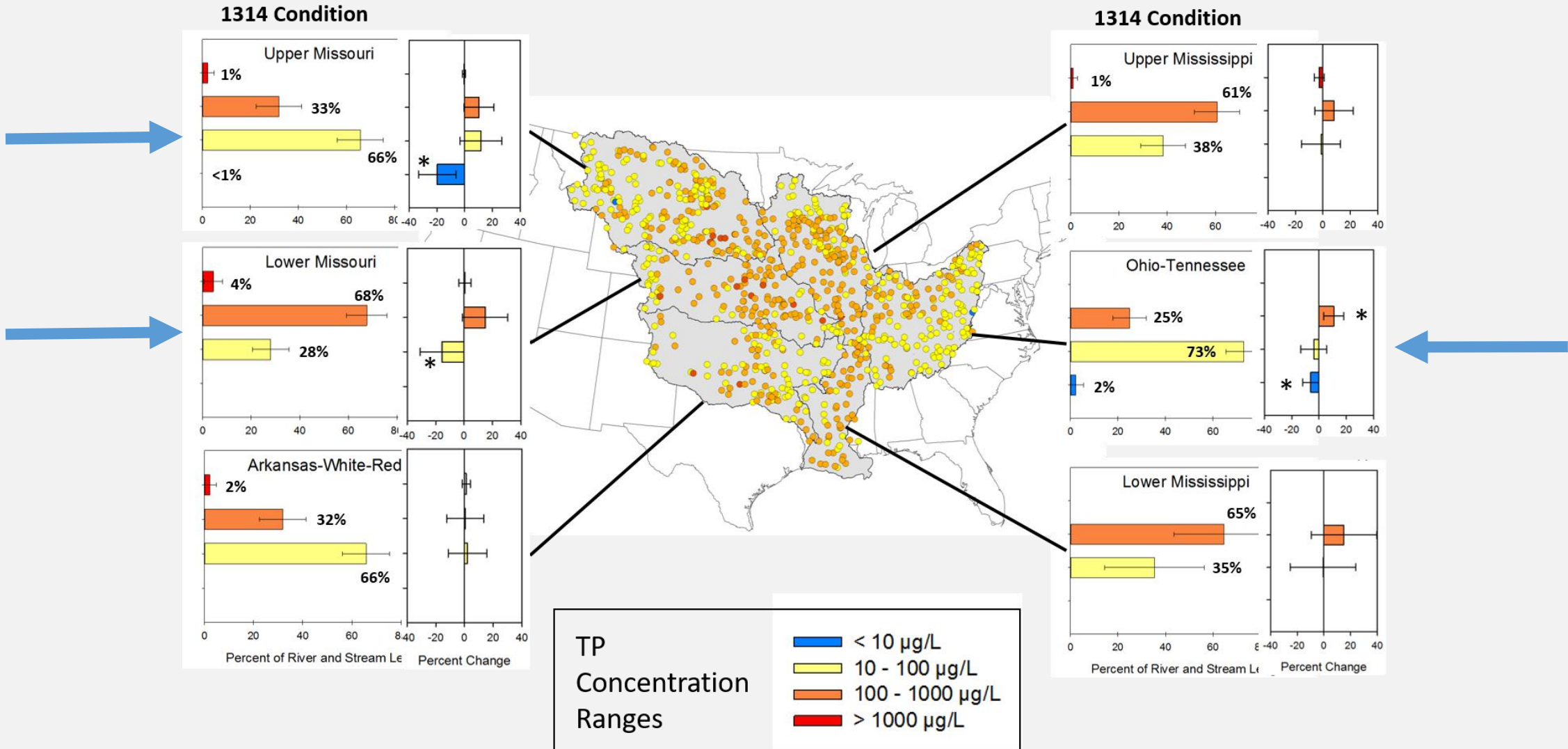


# Targeted: Across the country individual sites are up, down and not changing Is there a pattern regionally or nationally?



USGS: Water-Quality in the Nation's Streams and Rivers – Current Conditions and Long-Term Trends

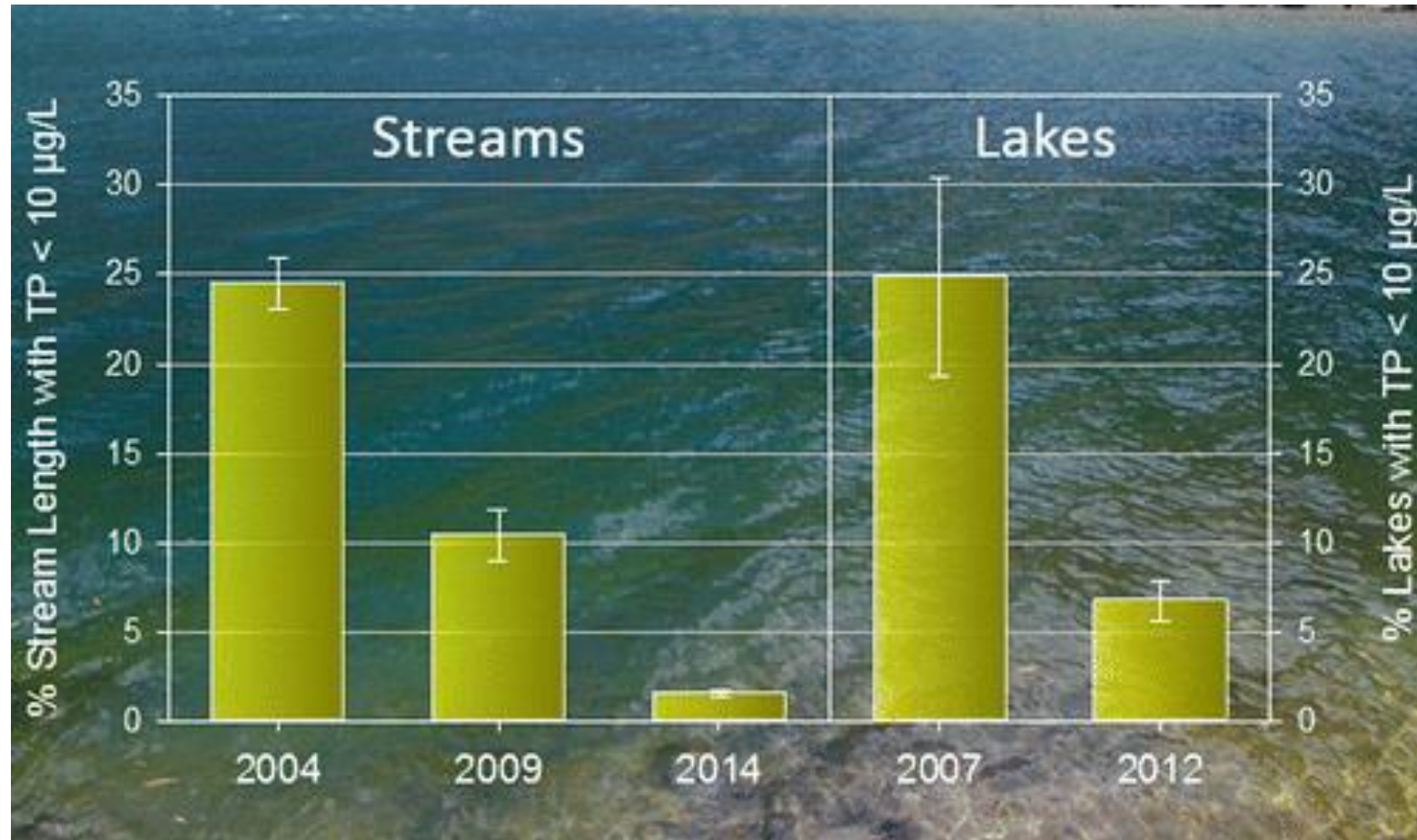
# Probability: NRSA 1314 Total Phosphorus Concentrations Statistically significant changes occurring in 3 Mississippi River basins (deterioration)



Error bars = 95% confidence intervals

Graphic: Michelle Maier, ORISE

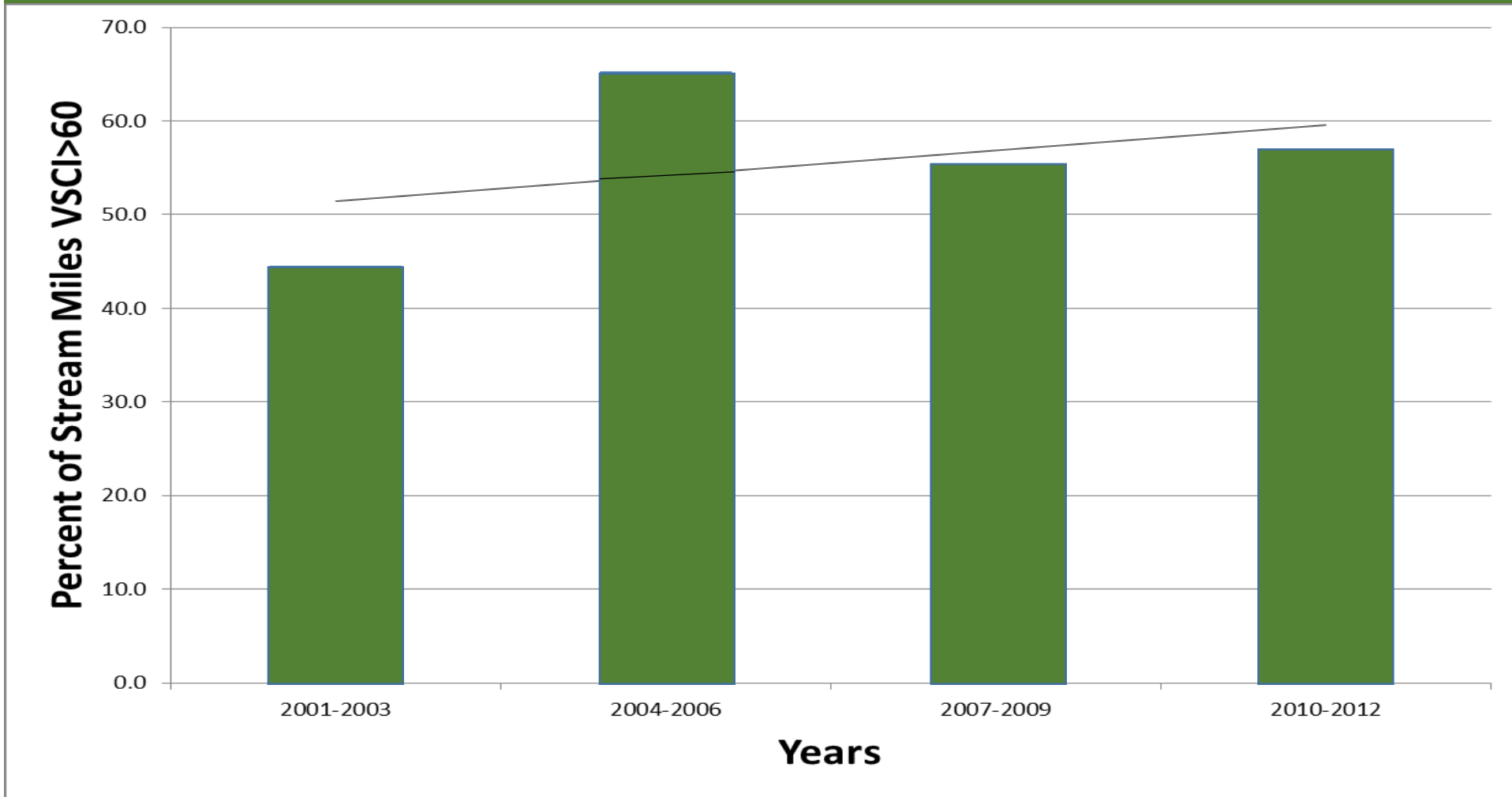
Probability: Shows significant change across the country (deterioration)  
Without probability surveys, we could miss this change



Stoddard, et al. (National Aquatic Resource Surveys data)

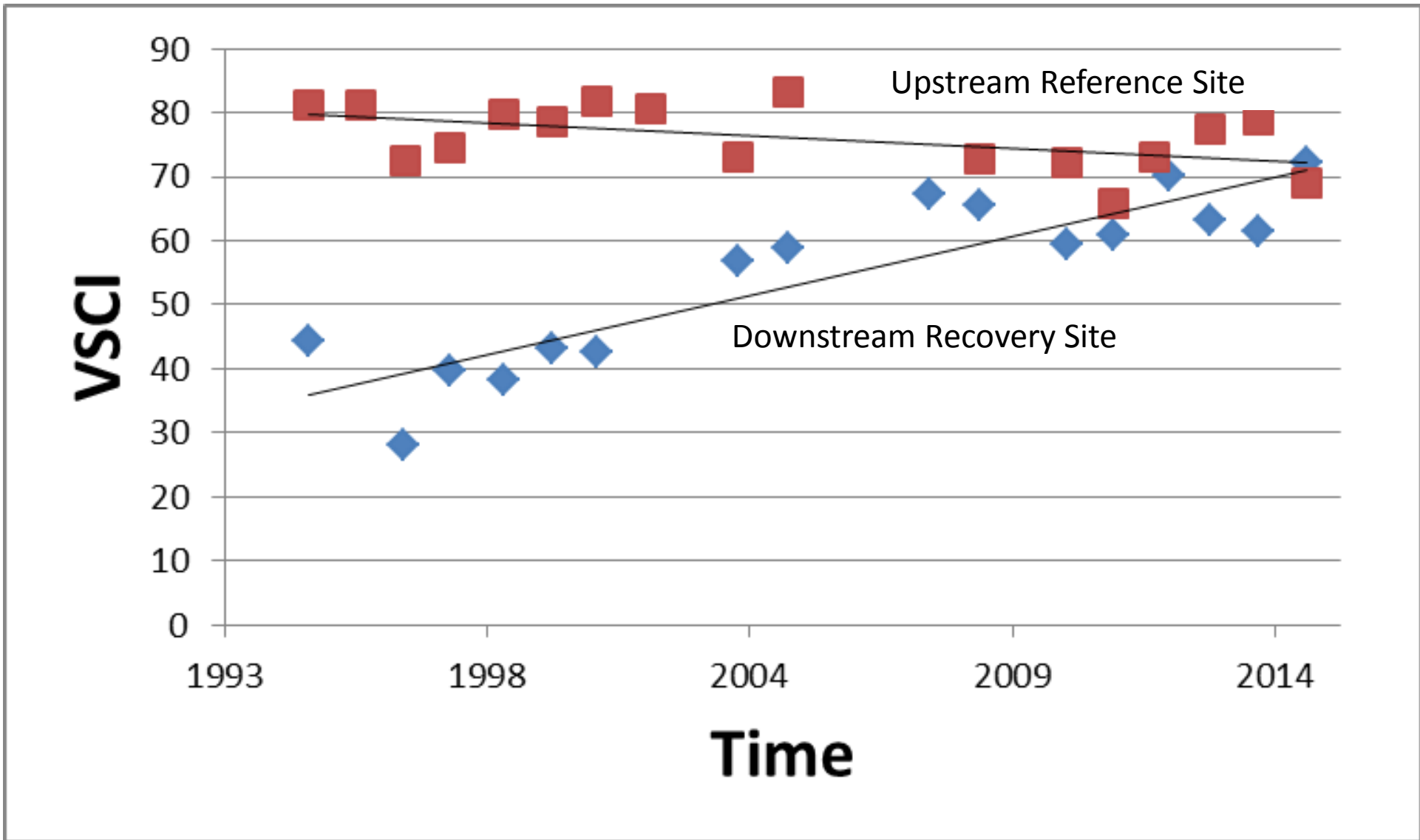
# Tracking Change Across the State with Statistical Survey

Percent of Stream Miles meeting Biological Expectations in Virginia



# Tracking Change for at a Single Project with a Targeted Design

## Jackson River TMDL Implementation Results



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Really know your questions and what you want/need to know

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One design or approach does not fit all

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Select indicators specific to your question and use

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Consider how state, regional and national scale information can help

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Other questions: When is monitoring needed? Who can help?

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Thoughts to keep in mind

# Resources

- Elements of a State Water Monitoring and Assessment Program
  - <https://archive.epa.gov/water/archive/web/html/elements.html>
- State/tribal monitoring strategies
- Water Quality Monitoring: A Guide for Informed Decision Making
  - [https://acwi.gov/monitoring/pubs/WIS\\_2017\\_fs/Desgin%20Overview%20Factsheet%20NWQMC.pdf](https://acwi.gov/monitoring/pubs/WIS_2017_fs/Desgin%20Overview%20Factsheet%20NWQMC.pdf)
- Monitoring and Evaluating Nonpoint Source Watershed Projects
  - <https://www.epa.gov/nps/monitoring-and-evaluating-nonpoint-source-watershed-projects>