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
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

• 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?
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)

Do not distribute: Preliminary results – 8/31/2017

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

From Using Probabilistic Monitoring to Assess the Effectiveness of Stream Management Efforts; Willis, Hill, Jones, Dail; VA DEQ
Tracking Change for at a Single Project with a Targeted Design
Jackson River TMDL Implementation Results

From Using Probabilistic Monitoring to Assess the Effectiveness of Stream Management Efforts; Willis, Hill, Jones, Dail; VA DEQ
Really know your questions and what you want/need to know

One design or approach does not fit all

Select indicators specific to your question and use

Consider how state, regional and national scale information can help

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

• Elements of a State Water Monitoring and Assessment Program

• State/tribal monitoring strategies


• Monitoring and Evaluating Nonpoint Source Watershed Projects