**Session M2: Evaluating Statewide Probabilistic and Fixed Site Monitoring Programs**

Room A105
10:00 – 11:30 am

**0037**
**M2-1**

**A Comparison of EPA and State Probabilistic Monitoring Methodologies in Arizona**

Jason Jones

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In March of 2000, the Government Accountability Office (GAO) criticized states and EPA for not assessing the water quality of all of the states waters as required by the Clean Water Act. In response, EPA created the National Aquatic Resource Surveys to address basic questions about the condition of the nation's waters. The national surveys use a probabilistic design to assess the condition of a particular waterbody at the national scale. This approach allows inferences to be made with a known statistical confidence for streams or other waterbodies that were not actually visited.

There are two options to assess water quality at the state scale. Some states choose to intensify the number of sites given for the national survey and use EPA protocols. Other states choose to use their own methods.

Arizona has completed a statewide assessment on streams using both EPA and State approaches. From 2000 to 2004, 47 sites were sampled as part of Western EMAP using EPA protocols. From 2007 to 2009, 50 sites were sampled using ADEQ protocols for macroinvertebrates, habitat and water quality.

The macroinvertebrate, habitat and chemistry results of both statewide assessments will be presented. An emphasis will be made on the strengths and weaknesses of each statewide assessment approach with respect to site reconnaissance failure rates, accuracy of target populations, comparability of results, applicability to state standards and integration with the 305(b) report.

**0164**
**M2-2**

**North Carolina's Assessment of the Attainment of Water Quality Standards Conducted through Probabilistic Monitoring**

Steven Kroeger, Andrea S. Thomas and Joe Olinger

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In 2007 North Carolina (NC) implemented a probabilistic water quality monitoring program. Monitoring was conducted monthly for two years at 29 sites during 2007-2008, and 31 sites during 2009-2010. Emphasis was placed on: 1) pollutants for which there are state numeric water quality standards, 2) metals (total and dissolved), 3) low level total mercury, 4) pesticides and organic compounds and 5) determining the proportion of sites meeting water quality standards. The addition of a probabilistic water quality monitoring program allows NC to cost-effectively assess surface waters for parameters not collected as part of our traditional ambient water quality monitoring program.

On a statewide level 12 parameters out of 42 that were assessed had results exceeding numeric water quality standards. The frequency of results exceeding standards for each parameter was very low (< 10%); the only exception was for iron at 37%. The frequency of detection rates for metals was less than 1% for all metals except copper, iron, zinc and low level mercury. Of the 904 total mercury results detected, 98% were below the NC water quality standard.

Approximately 240 organic compounds were evaluated; however, only 0.15% of the 193,812 results obtained were detected as being present - representing 27 compounds. None of the 60 monitoring stations had any exceedances of any numeric water quality standards for organic compounds for freshwater aquatic life or human health associated with their assigned stream classifications.

Out of a total of 60 sites sampled, 35 sites (58%) met all applicable numeric and biological water quality standards. On a site-by-site basis the parameters that exceeded numeric water quality standards by more than 10% were arsenic, copper, dissolved oxygen, mercury, turbidity, pH and zinc. Evaluations for aquatic life use (benthic macroinvertebrates and fish communities) resulted in bioclassifications for 36 locations. Excellent, Good, or Good- Fair bioclassifications (i.e. supporting) were found at 30 sites (81.1%).

The highest bioclassification of "Excellent" for either fish or benthic macroinvertebrates was found at 18 sites (48.6%). Bioclassifications for fish community and/or benthic macroinvertebrate evaluations of aquatic life uses were Poor or Fair (i.e. impaired) at six locations (16.2%).

**0193**
**M2-3**

**Probabilistic Versus Fixed Site Monitoring: Results from a Decade of Rotating Basin Design Monitoring in Oklahoma**

Shanon Phillips

*Oklahoma Conservation Commission, Oklahoma City, Okla., USA*

The Oklahoma Conservation Commission (OCC) manages an extensive monitoring program to determine the extent, nature, and probable sources of nonpoint source pollution. Through its statewide Rotating Basin Program, initiated in 2001, OCC monitors a total of 245 fixed sites at the outlets of most 10 digit watersheds on a staggered, rotational schedule by basin every five years. Sites are sampled every five weeks for two consecutive years, with approximately 100 sites assessed each year for standard water quality, aquatic habitat condition, and biological community health. In 2008, the OCC added a probabilistic component to its monitoring strategy to more fully characterize basin water quality condition and attainment of water quality standards. Each year, fifty randomly chosen sites within a basin are visited once to collect water quality, habitat, and biological data.

Data from these programs are used by OCC for many purposes, including use support assessments, watershed implementation project evaluation, watershed targeting, TMDL development, public education, and documentation of successful efforts of the State's conservation partners in land management and conservation programs. Preliminary analysis of the initial rounds of probabilistic monitoring shows very similar overall results to the more intensive fixed site monitoring. In times of budget shortfalls, probabilistic monitoring would allow a broad, general assessment of the health of streams in an area; however, the more rigorous fixed site monitoring provides the data to track declines and improvements in water quality on a local level. The results of the analysis of data from fixed and probabilistic sites in Oklahoma will be compared and contrasted, and the pros and cons of each design will be discussed in this talk.

**0509**
**M2-4**

**Ecological Condition Assessments of California's Perennial Wadeable Streams: Highlights from the Surface Water Ambient Monitoring Program's Perennial Streams Assessment (2000-2007)**

Shakoora Azimi-Gaylon[1], Peter R. Ode[2], Thomas Kincaid[3], Terrence Fleming[4] and Andrew Rehn[2]

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In 2000, the California State Water Resources Control Board (CA Water Board) initiated probability surveys of California's perennial streams and rivers focused on biological endpoints. These surveys are now managed collectively by the Water Board's Surface Water Ambient Monitoring Program (SWAMP) under its Perennial Streams Assessment (PSA) program. In 2010, SWAMP's conducted the State Board's eleventh year of monitoring perennial, wadeable streams. To date, the program has collected biological data (invertebrates, algae) and associated chemical and habitat data from approximately 850 sites statewide.

This report highlights some of the most significant results from the first eight years of PSA and demonstrates how these data can be used to improve California's water quality protection and restoration programs. It is organized around four questions based the State's Non-Point Source Program's management objectives:

1. What is the condition of California's streams?
2. Is stream condition changing over time?
3. What is the relative condition of streams draining agricultural, urban and forested regions?
4. Which stressors have the strongest associations with biological condition?

These surveys have produced a wealth of data that California's water resource agencies can use to protect and restore California's aquatic life resources. Land use and hydrology data collected to identify reference sites and potential monitoring locations provides managers with information about the extent of the resource available to support aquatic life uses. The probability-based monitoring design puts traditional, targeted monitoring results into context to help managers prioritize resource expenditures on restoration and

protection efforts. The probability- based design also provides biology-based indicators for evaluating how well water quality standards are protecting the aquatic life uses and can be used to interpret narrative criteria where numeric thresholds are difficult to establish (*e.g.*, nutrients).