# Abstracts

Wednesday, April 30

## Session F1: State Applications of Statistical Surveys

8:00 – 9:30 am | Room 263

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### *Lakeshore Habitat Condition of Wisconsin Lakes across Gradients in Land Use and Lake Area: Building on the National Lake Assessment*

**Catherine Hein, Caitlin Carlson, Paul Garrison and Timothy Asplund**
*Wisconsin Dept. of Natural Resources, Madison, Wis.*

**Abstract**
Nearshore lake habitat degradation has resulted in lower species diversity and altered species composition of macrophytes, macroinvertebrates, and fish in lakes across the nation. Although the biological impacts of habitat loss on lakes have been well-documented, state-level monitoring efforts still focus on trophic status indicators (*e.g.*, Secchi depth, total phosphorus, and chlorophyll). Poor lakeshore habitat can be predicted in part by high levels of agricultural and urban land use in the watershed, but these correlations leave much of the variance in habitat condition unexplained, indicating that lakeshore habitat monitoring is needed to assess local, within-lake habitat. The state of Wisconsin aims to initiate a lakeshore habitat monitoring program to improve its assessment of the state's ~15,000 lakes. As part of the National Lake Assessment, 39 randomly selected lakes were monitored for lakeshore habitat condition in 2007 and 50 additional lakes in 2012. In 2013, the Wisconsin Department of Natural Resources (DNR) monitored 100 randomly selected lakes stratified by lake area and land use within a 100 m buffer of the lakeshore. The goals of the 2013 monitoring efforts were to: 1) expand the assessment of lakeshore habitat condition across Wisconsin, 2) analyze lakeshore habitat condition in terms of lake area and surrounding land use, 3) develop ecoregion-specific lakeshore habitat metrics for Wisconsin, 4) introduce lakeshore habitat assessments to the monitoring programs of both the DNR and Citizen Lake Monitoring, and 5) use lakeshore habitat metrics in addition to trophic status to assess lake health. This paper will summarize the results of the lakeshore habitat monitoring effort across 189 lakes in Wisconsin and will discuss the DNR's efforts to initiate routine lakeshore habitat monitoring.

### *The Use of Probabilistic and Targeted Least Impacted and Severely Impacted Sites to Assess the Quality of Wisconsin's Wadeable Streams*

**Michael Shupryt, Brian Weigel, Tim Asplund and Michael Miller**
*Wisconsin Dept. of Natural Resources, Madison, Wis.*

**Abstract**
The Wisconsin Department of Natural Resources (DNR) has been using a strategy that combines a probabilistic monitoring design combined with a targeted site design to assess the State's wadeable streams. Wisconsin DNR biologists sampled nearly 600 sites using a probabilistic sampling design for water quality, macroinvertebrates, fish and physical habitat condition from 2010 to 2013. Probabilistic sites were stratified by Omernik Level 3 Ecoregion and stream natural community type in order to achieve resource balance. Wisconsin assigns all of the State's wadeable streams to one of ten natural communities based on predicted stream flow and temperature developed to predict fish community assemblages. During the 2010-2013 time frame, biologists also sampled 200 least impacted and 200 severely impacted sites with the same field protocols to act as bookends to the randomly selected sites. We analyzed the nearly 1,000 site dataset to 1) assess the condition of wadeable streams statewide, including the extent and risk of stressors; 2) determine the number of probabilistic sites needed to assess

condition; 3) determine the response of macroinvertebrate and fish IBIs to environmental stressors at the local and watershed scale; and 4) derive expectations for each natural community type. Preliminary analyses suggest that approximately 55% of the wadeable streams in Wisconsin are in poor condition for total phosphorus. Biologic assessments of macroinvertebrates and fish assemblages indicate that the majority of streams (~75%) are in fair to excellent condition. We will present findings and discuss implications for Wisconsin's ongoing wadeable stream monitoring and assessment strategy.

### *Using R to Analyze Data from Probabilistic Monitoring in Oklahoma*

**Jean Lemmon**
*Oklahoma Conservation Commission, Oklahoma City, Okla.*

**Abstract**
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 11 digit watersheds on a staggered, rotational schedule by basin every five years. 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. In this monitoring design, fifty randomly chosen sites each year within a basin are visited once to collect water quality, habitat, and biological data.

Preliminary analyses of the initial rounds of probabilistic monitoring showed very similar overall results to the more intensive fixed site monitoring. The statistical program "R" has been used to more fully examine the probabilistic data. Relative and attributable risk analyses have been completed for three of the five basins, allowing statistically robust determination of the health of streams for more than half of the state. The results of this data exploration will be discussed in this talk.

### *Evaluation of a Geometric Sampling Design Used to Assess Stream Resources and Identify Environmental Stressors in Watersheds*

**Michael Miller[1], Lori Tate[1], Ruth Person[1], Chris Yoder[2], Ed Rankin[2] and Bob Miltner[3]**
[1]*Wisconsin Dept. of Natural Resources, Madison, Wis.,* [2]*Midwest Biodiversity Institute, Columbus, Oh.,* [3]*Ohio Environmental Protection Agency, Groveport, Oh.*

**Abstract**
A goal of the Wisconsin Department of Natural Resources is to refine its stream monitoring strategy to gain sampling efficiencies and generate more robust information. WDNR partnered with USEPA Region 5 and the Midwest Biodiversity Institute, to evaluate the use of a "geometric" watershed sampling design. Two pilot study watersheds, each approximately 220 sq. mi. in size, were sampled at their pour points. Additional upstream sampling sites within each watershed were systematically chosen based on the drainage area of each sampling site. A geometric progression of watersheds sizes was selected: 110 sq. mi., 55 sq. mi., 27 sq. mi. and so-forth until the pour points for the smallest (2 sq. mi.) drainage areas were identified. Physical, chemical, and biological data collected at each sampling site were used to assess stream quality. A battery of statistical tests was then used to investigate which physical and chemical factors were most responsible for biological degradation, and to determine if stressor thresholds resulting in biological decline were evident. Bray-Curtis analyses identified biologically-distinct groups of stream sites based on fish or invertebrate assemblages. Non-metric multidimensional scaling, canonical correspondence analysis, classification and regression trees, and structural equation modeling were used to identify key physical and chemical factors influencing the integrity of stream biota. Quantile regression analyses helped identify thresholds for pollutant concentrations and physical stressors that resulted in declines in the biological integrity of streams.