Abstracts

Thursday, May 1

Session K5: Monitoring to Reflect Water Quality Changes from Management Actions

10:00 – 11:30 am | Room 233

Water Quality and Biological Trends in Ohio: Pre- Construction Grants Program to the Present

Robert Miltner
Ohio Environmental Protection Agency, Groveport, Oh.

Abstract
The Ohio Environmental Protection Agency has employed an integrated biological and water quality monitoring program since the early 1980s, and thus has information on surface water conditions before and after implementation of the Construction Grants Program. Prior to the Construction Grants, near all larger rivers and the majority of wadeable streams, in terms of linear stream miles, did not attain the basic Clean Water Act goal of fishable and swimmable. Fish species highly sensitive to pollution were restricted to a handful of refugia, and many other sensitive species had either reduced distributions or were rare. Recent monitoring has demonstrated that ninety percent of the linear miles of Ohio's large rivers now have an acceptable condition status, and over sixty percent of smaller rivers and streams are in an acceptable condition. Furthermore, several highly sensitive species have recovered nearly all of their historic ranges, or are expanding in distribution and abundance. The effect of the Construction Grants Program on water quality is especially evident in trends in ammonia-nitrogen concentrations. During the decade of the 1980s, ammonia concentrations measured from surface waters were significantly higher than those measured in 2000s. Biological and water quality monitoring has also revealed trends that appear related to efforts to abate pollution from diffuse sources, especially sediment from agriculture, as evidenced by decreasing concentrations of suspended sediment and total phosphorus coincidental with increasing abundances and distributions of several sediment-sensitive fish species.

Monitoring and Analyzing the Effectiveness of the Lower Minnesota River Low Dissolved Oxygen Total Maximum Daily Load Study's Wastewater Phosphorus Permitting Implementation Activities

Glenn Skuta and Katrina Kessler
Minnesota Pollution Control Agency, St. Paul, Minn.

Abstract
In August 2012, the Minnesota Pollution Control Agency (MPCA) completed a monitoring survey of the lower Minnesota River, one of the largest rivers in Minnesota. Data collected since the 1980s have shown that the river did not meet the dissolved oxygen (DO) water quality standard during the critical condition of low flow and high summer temperatures. The lower 22 miles of the river were listed as impaired in 1992. A total maximum daily load (TMDL) study and implementation plan were completed in 2004 and 2005 to address the impairment. The TMDL largely focused on reducing the discharge of phosphorus from wastewater treatment plants in the basin, since the impact of their discharges was most strongly manifested during low flow conditions. A basin-wide general phosphorus overlay wastewater permit was issued in 2005 that required phosphorus discharge reductions and facilitated pollutant trading to meet phosphorus discharge limits. The collective phosphorus reductions from wastewater treatment plant discharges called for in the basin-wide permit were achieved in 2012.

In August of 2012, flows below the 1,500 cfs TMDL monitoring trigger and elevated air temperatures were observed, causing the MPCA to initiate the monitoring survey. The survey ran for 3 weeks and included water chemistry data collection via sondes suspended by buoys and grab sampling at 7 sites along the length of the channel. Artificial substrates to monitor invertebrates were also deployed. While the statistical low flow critical condition (7Q10 of ~200 cfs) was not reached, flows were about half of the median daily level for much of the survey, and as low as ~850 cfs. High water temperatures were also observed, as high as 27.8 °C on the day of the

lowest DO reading. Despite the stressed conditions, analysis of the data showed no violations of the DO standard. Further, concentrations of total phosphorus and chlorophyll a were substantially lower than seen in previous studies.

Farms, Fish, Phosphorus and Phytoplankton: Long-Term Dynamics of a Reservoir Ecosystem Associated with Changes in Watershed Agricultural Practices

Michael Vanni, María González and William Renwick
Miami University, Oxford, Oh.

Abstract
Many agricultural practices are changing rapidly, but few studies have assessed the response of downstream lakes to such changes. We quantified the dynamics of a eutrophic reservoir ecosystem (Acton Lake, Ohio) over 20 years, during which watershed agricultural practices changed substantially. Changes include a pronounced increase in conservation tillage, and decreases in P fertilizers and the number of hogs in the watershed. Over the first 13 years (1994-2006), when agricultural changes were most pronounced, discharge-standardized loads of suspended sediment (SS) and phosphorus (P) from the watershed to the lake decreased substantially. Despite the decrease in external inputs of P (the limiting nutrient), phytoplankton biomass (chlorophyll) increased ~40% over this period. Over the same period, the concentration of non-volatile SS in the lake also declined substantially; this apparently alleviated light limitation of phytoplankton, allowing their biomass to increase. Internal P supply via excretion by sediment feeding fish (gizzard shad, *Dorosoma cepedianum*) also increased over this period, because of an increase in fish biomass. These fish consume sediment-bound P and excrete some P into the water column, thereby functioning as nutrient pumps that sustain ~30% of phytoplankton production. Thus, internal P supply by fish apparently compensated for the decline in watershed-derived P over the first 13 years. However, over the past 6-7 years, P and SS loading rates from the watershed, and in-lake NVSS concentrations, have remained relatively constant. Gizzard shad biomass has also stabilized. Over this latter period, phytoplankton biomass has not shown a significant change. Using all years in a multiple regression, P excretion by fish and NVSS concentration explain over 60% of the variance in annual mean phytoplankton biomass (chlorophyll).

Our results strongly suggest that annual mean phytoplankton biomass in this eutrophic reservoir is regulated by the combined effect of suspended sediments and P excretion by fish. P loading from the watershed is not related to phytoplankton biomass within a year, but plays a role at longer time scales by providing P for internal cycling. These results suggest that reversal of eutrophication in agriculturally-impacted reservoirs will be most effective if both external P inputs and fish biomass are reduced.

Multiple Uses of Data from an Automated Monitoring Network in a 6-Mile Urban Stormwater Tunnel

Britta Suppes and Bob Fossum
Capitol Region Watershed District, St. Paul, Minn.

Abstract
Since 2004, Capitol Region Watershed District in St. Paul, Minnesota has operated a comprehensive network of automated stormwater monitoring sites to evaluate stormwater flow through the Trout Brook Storm Sewer Interceptor (TBI), a 6-mile stormwater tunnel draining over 5,000 acres of a fully urbanized area to the Mississippi River. At its largest, the TBI stormwater tunnel is over 12 feet in diameter.

The goal of the TBI monitoring network is to measure and characterize water quantity and quality of stormwater flowing through the tunnel from the upper reaches of the watershed to the outflow location at the Mississippi River. Monitoring stations include: three deep stormwater tunnel flow and water quality measuring sites; two flow-only stations located at lake outlets; four level-only loggers in stormwater ponds; and three automatic precipitation gauges.

TBI water quantity and quality data has been continuously collected, recorded, and analyzed by CRWD from 2004 to 2013, creating a lengthy and robust dataset characterizing trends in total discharge, pollutant loading, and climatic patterns. The data is reported annually in CRWD Monitoring Reports and available to the public and local partners. In addition, the data has been utilized to inform a variety of projects, including: Hydrologic and Hydraulic

model calibration for flood prediction and improved operation and maintenance of the TBI; loading calculations for the South Metro Mississippi River Turbidity TMDL; and loading calculations for minor subwatersheds of TBI to inform management decisions, such as the identification of optimal locations for stormwater best management practices. The data has informed major project design, including the replacement and rehabilitation of three large sections of the TBI stormwater tunnel and the recreation of a 3,000-foot natural stream channel in the former Trout Brook Valley.