Report as of FY2010 for 2009KY133B: "Ten year assessment of the Kentucky River Watershed Watch Program"

Publications

- Conference Proceedings:
  - Akasapu, Madhu and Lindell Ormsbee, 2010, Relatonship Between Fecal Coliform and E. coli Values within the Kentucky River Basin, in Proceedings Kentucky Water Resources Annual Symposium, Kentucky Water Resources Research Institute, Lexington, Kentucky, p 89-90.

Report Follows

Ten-Year Assessment of the Kentucky River Watershed Watch Program

Problem and Research Objectives

The Kentucky River Watershed Watch (KRWW) organization was formed in 1997 to enable citizen volunteers to sample local waterways within the Kentucky River Basin and learn how to improve and protect water quality. KRWW has grown to include approximately 250 volunteers living throughout the basin, which extends over much of the central and eastern portions of the state and is home to over 710,000 Kentuckians. The watershed includes all or parts of 42 counties and drains over 7,000 square miles, with a tributary network of 15,000 miles.

Since the inception of KRWW, the Kentucky Water Resources Research Institute has assisted its volunteers with data analysis by producing a yearly summary report of water quality sampling results. A five-year analysis was completed in 2004. With the accumulation of over 10 years of sampling data, a longer term analysis and summary of KRWW sampling results through 2009 was possible to assist the organization and its volunteers by providing further interpretation. Additionally, a survey of KRWW leadership and volunteers and their resulting recommendations helped strengthen the organization and helped participants better achieve their overall mission and goals.

This project compiled and statistically analyzed KRWW's water quality data collected between 1999 and 2009 (NOTE: Data for 11 years). The resulting summary report, titled *Kentucky River Watershed Watch: A Summary of Volunteer Water Quality Sampling Efforts in the Kentucky River Basin from 1999 to 2009,* was distributed to KRWW volunteers via face-to-face meetings and through electronic methods (e-mail and online posting).

http://www.uky.edu/OtherOrgs/KRWW/KRWW_Ten_Year_Report_Final_Version.pdf

The report includes 1) a short history of the KRWW organization; 2) an overview of sampling efforts; 3) an analysis of the annual spring, summer and fall sampling events; 4) field chemistry results; 5) a list of sampling sites and watersheds of concern; 6) how volunteers can apply their data; and 7) an assessment of the current status of the KRWW organization. The report also includes appendices describing individual water quality parameters and instructions for using the interactive, online KRWW database.

Methodology

A Microsoft Access database and Microsoft Excel were used to compute statistical analyses of KRWW water quality data. For most parameters, geometric means were calculated to determine averages for the assessment period when at least three separate results were available. In order to interpret these results, graphs were created that compared the geometric means to specific water quality standards established by the state of Kentucky to protect waterways for aquatic life and human uses.

The summer pathogen samples were analyzed for fecal coliform from 1999-2007 and for E. coli from 2008 to 2009. In order to compare the sampling results over the entire period, a statistical analysis was conducted to determine a relationship between the two pathogen indicators. Once this relationship was established between fecal coliform and E. coli, a t-test was used to determine if a sampling site showed improvement (decreased pathogen levels) by comparing the 1999-2003 five-year time period with the 2004-2009 six-year time period. To

perform this test, available data were converted to natural logarithms and the respective t-test statistic was examined to evaluate if changes were statistically significant. Unfortunately, several sampling sites lacked sufficient data for such a comparative analysis.

A KRWW volunteer survey was conducted in 2009 using an online service. This survey assessed opinions on the importance of specific KRWW functions (general coordination, monitoring, training, volunteer events, subwatershed projects, and advocacy) and how well they were being performed. The survey results were compiled in an Excel spreadsheet and summarized in narrative format.

Overall data interpretations were summarized in a narrative final report, along with appropriate tables, graphs and maps. Arcview GIS applications were used to produce the maps for the report. The report, as well as the full KRWW database, is posted on the KRWW website at www.krww.org for public access. The report is also available by a link from the KWRRI web site.

Principal Findings and Significance

In 1999, Kentucky River Watershed Watch volunteers sampled at 87 sites throughout the basin. After reaching a high of 248 sites in 2006, the number of sites decreased to 171 in 2009. Sampling has become increasingly more concentrated in the central region of the Kentucky River Basin, which includes the more densely populated, urbanized areas. Thus, there are currently more KRWW data results for this central region than for the upper basin areas in southeastern Kentucky or the lower basin in northern Kentucky. Figure 1 illustrates the changes in sampling site distribution from 1999 to 2009. In 2009, there were no sites located in the South and Middle Forks of the Kentucky River and only a few in the northern portion of the Kentucky River Basin.

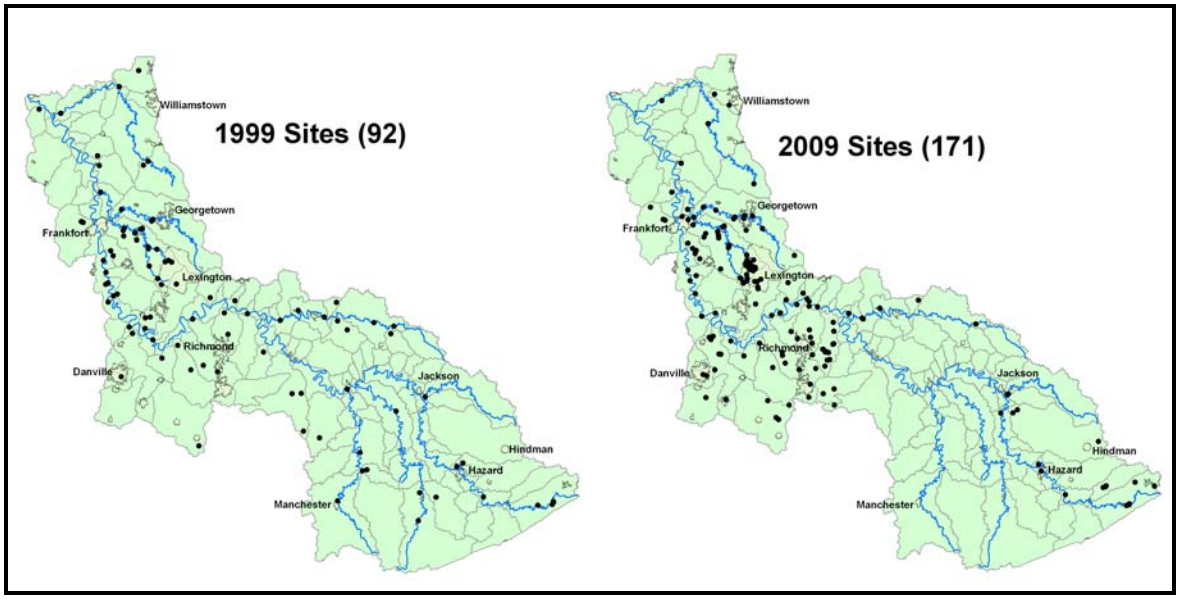

Figure 1. Comparison of 1999 and 2009 KRWW Sampling Locations

KRWW volunteers typically sampled the water quality at their chosen sites three to four times each year. The sampling events included herbicides and an insecticide (spring), synoptic

and follow-up pathogens (twice in summer), and metals, chemistry, and nutrients (fall). Pesticides were analyzed during the spring sampling event due to the increased likelihood of recent crop applications. Pathogens were assessed during the summer months, when people were more likely to be coming in direct contact with waterways through various recreational activities. The nutrient, chemical and metal parameters were analyzed during the fall water sampling event because of the typically lower flows observed during this time of year and the associated potential for increased concentration. In addition, samplers analyzed dissolved oxygen, pH, temperature, conductivity, and habitat condition in the field during sample collection.

Figure 2 illustrates the number of samples collected during each major sampling event from 1999 through 2009. The number of herbicide and insecticide samples that were collected were relatively low, because they were generally only assessed at newly sampled sites. Follow-up pathogen sites included only those sites where pathogen concentrations exceeded the safe swimming standard during the initial synoptic sampling event. Metals were only assessed for specific sites during the fall, low-flow sampling events.

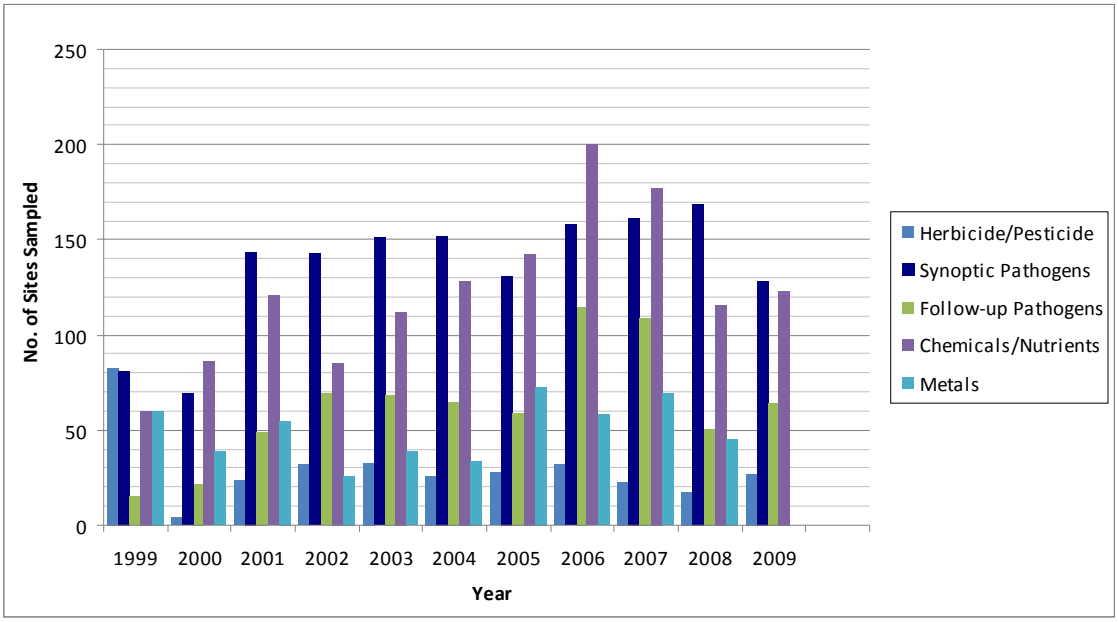

Figure 2. Number of Sites Sampled During Regular Sampling Events (1999-2009)
NOTE: No metals were assessed during 2009

Water quality results collected during each of the annual sampling events were entered into a Microsoft Access database and assessed. This assessment was based upon averaging sampling results for sites with data from at least three of the eleven sampling years for comparison with available water quality standards. The following water quality parameters were assessed: herbicides (Metolachlor, Atrazine, 2,4-D), insecticide (Chlorpyrifos), pathogens (fecal coliform and E coli), nutrients (nitrate nitrogen, total phosphorus, sulfate), metals (antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, nickel, selenium, silver, thallium, zinc), dissolved oxygen, pH, and temperature.

This analysis of eleven years of KRWW sampling data from 1999 through 2009 provided evidence of water quality concerns throughout the Kentucky River Basin. A list of sampling

sites and associated watersheds of concern was produced, along with a map showing their locations within the Basin.

In the future, this type of analysis could be strengthened by the availability of more continuous data for the individual sampling sites. By sampling regularly year-to-year, volunteers will be more likely to gain valuable insights to the current status and changes of water quality at their chosen sites. For many of the sampling parameters, water quality issues were most evident in the central region of the Kentucky River Basin. Although these findings are instructive, it should be noted that a disproportionate share of the KRWW sampling sites are located in this region.

This analysis of KRWW water quality results was intended to provide KRWW volunteers and organizers with information to guide continued sampling, focused sampling, and water quality improvement efforts. Additional sampling data from future sampling years will be useful to build on this analysis and strengthen its conclusions.