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# Nutrient and fecal microbe assessment of the water quality of Tates Creek, Madison County, Kentucky

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# NUTRIENT AND FECAL MICROBE ASSESSMENT OF THE WATER QUALITY OF TATES CREEK, MADISON COUNTY, KENTUCKY

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Tates Creek is a significant tributary to the Kentucky River that has shown high levels of microbial and nutrient pollution in the past (Kentucky River Watershed Watch). We sampled the waters of Tates Creek more comprehensively by collecting stream water at 25 stations along its 13-mile length from its headwaters to the Kentucky River. Most samples were collected at the confluence of major tributaries to also access the water quality of tributary streams. Samples were collected four times between May and August 2011 during dry periods as well as immediately after a rainfall event. We measured ammonium ($NH_4^+$), nitrate ($NO_3^-$), and phosphate ($PO_4^{3-}$) concentrations using colorimetry. Microbial samples were measured for total coliform and *Escherichia coli* using IDEXX Colilert-18 media and methods.

Background levels of $NH_4^+$, $NO_3^-$ and $PO_4^-$ are typically ~0.3 mg/L, 5 mg/L, and 1.0 mg/L, respectively. Thus, phosphate concentration almost always exceeds EPA criteria for freshwater (0.1 mg/L). Background levels of nutrient concentrations generally increase during rainfall events, presumably because nutrients are flushed into the stream. Background counts of *E. coli* are typically ~100 cfu/mL but *E. coli* counts reached 1,000 to 2,419 cfu/mL immediately following rain events. Some areas also show microbial counts far in excess of background levels. Microbe counts tend to be high in the headwaters of Tates Creek where we suspect leaky and/or broken sewage lines are responsible for high *E. coli* counts. Other high counts also occur adjacent to active pasture. Thus, fecal microbe pollution in Tates Creek occurs from both human and bovine sources.

A sewage treatment plant existed approximately two miles from the headwaters of Tates Creek and noticeably affected water quality. Upstream of the plant, nutrient levels are low, whereas nutrient concentration, especially $NH_4^+$ and $PO_4^-$, are markedly increased at the plant's outflow. These nutrients then decrease steadily in concentration downstream to background levels. In contrast, when the plant was operating fecal microbe counts are high upstream from the plant, but fall to near-zero levels at its outflow, and then increase anew downstream. The treatment plant went off line on 19 July 2011 and subsequent sampling showed nutrient levels no longer spike immediately downstream. *E. coli* counts remained high upstream and downstream of the plant because stream waters are no longer diluted by plant outflow that carried almost no microbes. A companion study sampled stream biota before and after the plant shut down. Thus, we will be able to note any changes in stream biota attributable to changing nutrient levels.

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