

Introduction

Streams, which receive emissions from urban areas or cities, mining areas and wastewater treatment facilities can become contaminated with bacteria, organic chemicals, and chemical elements including heavy metals. Corrosion of plumbing pipes could result in emissions of heavy metals into the streams. The use of detergents and fertilizers could result in emissions of phosphorous into streams. Three local streams receive emissions of materials from three separate cities. **Wilson Creek** drains the city of Springfield and has been affected by wastewater overflow from a wastewater treatment facility. The facility treats incoming wastewater with concentrations of copper, lead, zinc and phosphates. **Pearson Creek** drains the city of Strafford and has received emissions of zinc and smaller concentrations of lead from mining activities and mineral ore deposits located near the mouth of the stream. **Sawyer Creek** receives drainage from the city of Rogersville. Each stream is about the same length. The length of Wilson Creek is about 5.19 kilometers, that of Pearson Creek, 5.69 kilometers and Sawyer Creek, 5.68 kilometers. The channel of each stream is located in the same geologic rock and each stream drains directly into the James River.

The determination of substances in stream sediments instead of stream water has been used to evaluate the “quality” of stream systems. Concentrations of heavy metals and phosphorous in stream sediments has been used to determine the “quality” of the stream.

Hypothesis

Based on the size or population of the city, which each stream drains and the effects of other known emissions sources on the streams, I think Wilson Creek would have higher concentrations of heavy metals and phosphorous present in the stream sediments, Pearson Creek the second most, and Sawyer Creek the least concentrations of these metals. I also think the trend of the concentrations of these elements along the stream course could define and verify specific known emission sources. Examples would be higher zinc concentrations near the mouth of Pearson Creek because of the presence of zinc mines upstream from that location or higher P concentrations downstream from a wastewater treatment facility on Wilson Creek because of past wastewater overflow.

Procedure

I used road maps and collected six sediment samples from each stream mentioned above. Two samples were collected near the headwaters, two from the center, and two from the area near the mouth of each stream. Each sample pair was collected approximately 50-100 feet apart. All samples were collected from the stream with the use of a hand hoe and placed in labeled plastic sandwich bags.

All samples were dried and disaggregated with a mortar and pestle. Each sample was passed through a 63- mesh sieve screen. A portion of each sample weighing approximately 0.5000 grams was added to a centrifuge bottle. Ten milliliters of 3N nitric acid was added to each bottle. The bottles were placed in a

hot water bath and shaken at 80 degrees C for 12 hours. All bottles were centrifuged and the liquid portion of each sample was placed in an analysis bottle for chemical analysis.

The concentration of copper, lead and zinc in each sample was determined with the use of the Shimadzu Atomic Absorption Analyzer. The concentration of phosphorous in each sample was determined with the use of a Varian 150 AX ICP Emission Spectrophotometer. The concentration (PPM) of each element was recorded. Microsoft Word and Excel were used to aid in the presentation of the data for this project.

Results

The [location map of collection sites](#) along the streams is shown. The concentrations of all elements in the sediments of the three streams are shown in [table 1](#). The [mean concentration of each element in each stream](#) is shown in the next table. The [trend chart for copper](#) concentrations in the sediments is shown. The concentrations of copper appear to be highest at the headwaters of Wilson Creek. This is the closest proximity of stream to the city of Springfield. The concentrations of copper display a decreasing value with distance along Wilson Creek.

The [trend chart for lead concentrations](#) in the sediments is shown. The concentrations of lead are highest at each headwater area and decrease downstream with distance except for the two samples near the mouth of Pearson Creek. The high values of lead could be caused by the emission of metal present in small amounts in the ore mines located upstream from these two samples.

The [trend chart for zinc concentrations](#) in the sediments is shown. The concentration of zinc is greatest at the headwater area of Wilson Creek. The same is not true for zinc concentrations at the headwaters of Pearson and Sawyer Creeks. The concentration of zinc increases abruptly in the samples near the mouth area of Pearson Creek. I believe this is due to the presence of the zinc mines located in a close proximity upstream.

The [trend chart for the phosphorous concentrations](#) in the sediments is shown. The concentrations in the sediments of Wilson Creek appear to increase downstream from the headwaters with a large increase in the sediments near the mouth. This could represent the emissions of P by the wastewater treatment facility located between the middle and mouth portions of this stream. The P concentrations show a decreasing trend in Pearson Creek from the headwaters to the mouth. As mentioned before, the [mean concentration of each element in the sediments](#) in each stream is shown. The concentration of all metals is highest in Wilson Creek, second highest in Pearson Creek, and lowest in Sawyer Creek.

Conclusions

The concentrations of elements in the sediments of the study streams appear to be affected by a few factors. These include population density and total area of the city, ore mines in the area and a wastewater treatment facility. The concentrations of all elements were highest in the sediments of Wilson Creek, next highest in Pearson Creek, and lowest in Sawyer Creek. All of the above observations were the same as in my original hypothesis. From the results I could say Sawyer Creek is cleanest, Pearson Creek next cleanest, and Wilson Creek the least clean. However, I know the concentrations of other substances must be included before this judgment is made.

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