Keeping you up to date on South River Science Team activities Second Half 2008

At A Glance:
Historical Mills and Dams Tell Different Story of River Flow

The South River today is an energetic, free-flowing stream with many rapids and pools, but when mercury was introduced into the river in the early part of the 20th Century, the river was different. According to historical sources documented in *Mills of Augusta County*, by J. and E. Downs, there were as many as 20 mills along the South River from Waynesboro to Port Republic at the beginning of the 20th Century. Each mill had a dam upstream to raise the water level for power generation, causing a series of mill ponds. Studies by members of the South River Science Team indicate that most of these mill dams had been breached by the middle of the 20th Century, increasing the river flow rate and allowing erosion. The erosion creates more clay, silt, and sand in the river flow and some of these particles may be contaminated with mercury. Understanding the dramatic changes that have occurred along the South River in recent decades helps the Science Team better understand and alleviate the mercury problems of the South River and its valley.

A former mill dam and race near Grottoes.

In This Issue…

About this Newsletter…

In the Fall 2000, the South River Science Team was formed to serve as a focal point for technical issues concerning mercury in the South River and downstream waterways. The Science Team is a cooperative effort between the Virginia Department of Environmental Quality, Department of Health and the Department of Game and Inland Fisheries and representatives from academia, citizens groups, the Environmental Protection Agency and DuPont. The Science Team provides technical direction for the mercury monitoring program and ensures that there is effective communication provided to the users of the river. The Science Team's goal is to understand why mercury in South River fish has not decreased over time and to identify potential solutions to improve the situation.

TechCorner:
Study Finds Tributaries Not a Major Mercury Source

The South River Science Team recently completed a study to evaluate the importance of tributaries as mercury sources to the South River. A tributary is a stream or channel that flows into a larger mainstream or parent river. The team collected water samples from tributaries and at bridge crossings on the South River before, during, and after storm events in October 2007 and May 2008. The study results indicate that tributaries are not a major source of mercury to the South River.

The area between Lyndhurst and Crimora was selected for the study based on the number of tributaries and other small streams and information gained from previous studies. Fourteen tributaries, ranging from large streams like Steele Run to small ditches that drain agricultural areas, are located in this area. Previous studies indicated that elevated levels of mercury in sediment and floodplain soil are found in this area. Because it is unsafe to access some of these areas during storms, advanced planning and new sampling methods were employed to measure tributary contributions safely when water levels were high.

Photograph of the South River during a storm.

Storm sampling is challenging because it is difficult to predict the duration and intensity of storms. Prior to the rainy season, Science Team members deployed passive water sampling devices that filled up with water only when the tributaries reached a certain water depth. Before the storm event occurred, the team began sample collection from bridges so that the amount of mercury carried by tributaries could be compared to the amount carried by the river.

An important and challenging part of measuring the mercury contribution from tributaries is measuring stream discharge, which is the amount of water transported in a certain amount of time. Electronic devices were deployed with passive samplers to measure the pressure changes caused by changing water levels. The devices were placed in the streams one day before the rain started, and data were recorded every 15 minutes. Other streams that were small enough for the team to wade safely were measured using an Acoustic Doppler Velocimeter (ADV). An ADV measures water velocity by sending a sound pulse though the water and measuring the change in that sound pulse caused by particles in the water. The amount of change is related to the depth of the water and how fast the water is moving.

An ADV is used to measure tributary discharge.

Using the concentration and discharge data, the team measured the total amount of mercury carried by each tributary over the course of the storms and compared it to the river as a whole. Study results indicate that all of the tributary contributions accounted for less than 8% of the mercury and less than 4% of the methylmercury in the South River for both storm events.

Based on the results of this study and other studies, mercury associated with soil and sediment in river banks and the streambed may be more important than the mercury that enters the river through tributaries. The Science Team is currently designing studies to understand how river bank and streambed sources contribute mercury to the South River.

For more information about this study, contact Mike Liberati at michael.r.liberati@usa.dupont.com or (302) 892-7421.

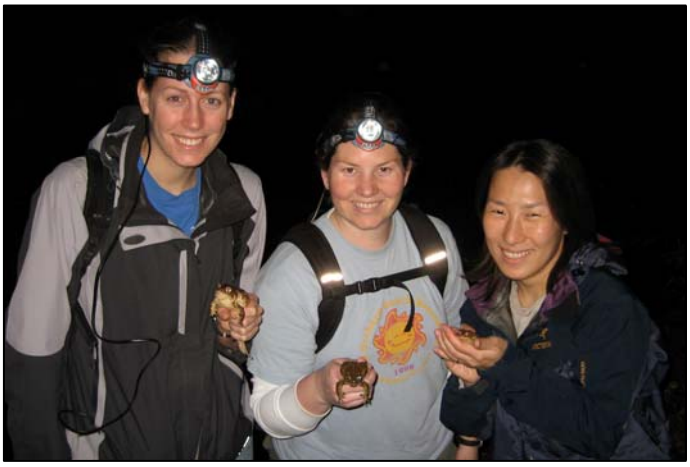
From the Team…
Virginia Tech Scientists Use Amphibians as Sentinels of Environmental Quality

South River Science Team biologists are focused on determining how mercury cycles through aquatic (water) and terrestrial (land) food webs. Most research to date has focused on understanding mercury accumulation and potential effects in songbirds and fish. More recently, Virginia Tech has teamed up with the Science Team to study amphibians. The goal is to understand the ecological role of amphibians in relation to mercury transport and cycling and determine whether mercury exposure causes adverse effects on amphibians or the animals that eat them.

Amphibians are important to include in the food web analyses because they are excellent indicators of environmental health. Because amphibians have permeable skin, they are believed to be sensitive to changes in moisture and temperature, as well as environmental contaminants. In addition, many amphibians have complex life cycles: terrestrial adults lay their eggs in water where the embryos and tadpoles develop, eventually undergoing metamorphosis to become juveniles in the terrestrial environment. These developmental patterns mean that amphibians depend on both healthy aquatic and terrestrial habitats to be successful. Because of these and other factors, amphibians are the most endangered class of land vertebrates on the planet today. Thus, determining whether mercury affects amphibians may provide early warning signals about the effects on other wildlife.

An American toad mating pair found along the South River.

Over the last two springs, Virginia Tech researchers have characterized the amphibian community tissue mercury profiles along the South River. Among the most common species encountered is the American toad (*Bufo americanus*). Because this species has a complex life cycle, different life stages are exposed to mercury via different routes in different habitats. For example, adult female toads primarily accumulate mercury from the insects they eat in the floodplain. These females then pass some of this mercury into their eggs, a process called maternal transfer. Because developing embryos are very sensitive to even small disturbances, the process of maternal transfer is critical to understanding wildlife health along the South River. By measuring mercury concentrations in the eggs and then tracking the embryo and tadpole development, some important discoveries were made.



Virginia Tech scientists at work in the field.

The maternal transfer of mercury appears to cause a decline in the hatching success of embryos, but the hatchlings that successfully hatch from mothers exposed to mercury appear to be exceptionally healthy--even healthier than hatchlings not exposed to mercury. This year, the team will be tracking tadpole development, the next portion of the toad's life cycle. Thus far, the field work results indicate that tadpoles experience higher exposure to mercury than adults or embryos because they feed on sediment and other materials that are particularly enriched with mercury. The findings will eventually provide a comprehensive assessment of the effects of mercury on amphibians, allowing the team to identify potential management strategies that may improve the health of these sensitive and ecologically important creatures.

For additional information, contact Dr. Bill Hopkins at hopkinsw@vt.edu or (540) 231-5573.

Did You Know?
Riverfest Scheduled for April 25, 2009

Over 600 rubber ducks raced in the 2008 Great South River Duck Race during Riverfest last year.

Waynesboro's annual Riverfest event is scheduled for Saturday, April 25, 2009, from 10 A.M. to 4 P.M. along the banks of the South River in Constitution Park. The mission of Riverfest is to promote environmental conservation and watershed stewardship in the Shenandoah River basin. The free event has been gaining in popularity every year and next year is sure to be the best. Educational events will include Stream Safaris where folks can learn about life in the South River, an electrofishing demonstration, a macroinvertebrate display, and an exhibit of local wildlife provided by the Wildlife Center of Virginia. Other Riverfest events will include a Road and River Relay race, a Fish 'n Fun Rodeo for children to test their casting skills, canoe rides provided by local Boy Scouts, and a Reptile World exhibit. The culmination of Riverfest is the Great South River Duck Race. For the race, attendees "adopt" a rubber duck with a number on it and then the ducks race down a portion of the river. Prizes are awarded to the winners.

Money raised as part of this community event is used as seed money for the following year's event and supports the Living Cave/Living River exhibit in Grottoes as well as local Trout-in-the-Classroom projects. Anyone interested in providing financial donations or volunteering for Riverfest should contact Scott Gregory at (540) 949-5361. For more information, visit **www.riverfestwaynesboro.org**.

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To be added or deleted from our distribution list, contact Kathy Adams at (302) 892-8301.

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