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

At A Glance: Bank Restoration on the South River

The South River Science Team plans to restore part of a South River bank to reduce the erosion of mercury-containing soils into the river and to enhance the fish habitat in the area. The riverbank, located downstream of the Invista plant, is a few hundred feet long and approximately 8 feet high. This bank section is an example of how soil erosion hinders the quality of the South River fish habitat by introducing mud into the river. Although the design of the bank restoration is just taking shape, one idea is to build the bank into the river to restore its shoreline and shape. The Science Team will plant vegetation to stabilize the repaired bank and prevent erosion from reoccurring. In addition, the team will plant trees at top of the riverbank to provide shade in the summer. The Science Team will meet with various stakeholders, such as the City of Waynesboro, to refine the design and plans to implement the restoration in Fall 2009.

Photograph of a bank on the South River that is targeted for restoration.

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:
Phase I Ecological Study Nears Completion

Members of the South River Science Team are conducting an ecological study to understand how mercury enters the food web of the South River. The ecological study, which consists of two phases, was designed in consultation with representatives of the Natural Resources Defense Council to complement ongoing Science Team studies. Phase I, which began in March 2006, is a two-year study that seeks to fully characterize the ecological communities and habitats of the South River and identify where mercury enters the South River. The results of Phase I will set the stage for Phase II, which is a four-year study of potential impacts of mercury to the environment. As the Phase I study nears completion, much has been learned about the ecological health of the South River and how mercury enters the river. This information is critical to the design of effective Phase II studies and to understanding the effects of mercury in the South River.

These photos were taken along the South River near Crimora, Virginia, in Spring 2006 (left) and Summer 2006 (right) and illustrate the seasonal variations in the river. The South River ecological study is designed to understand how variations in characteristics like river flow, aquatic plant growth, and water temperature affect mercury transport.

In the Phase I study, Science Team members performed comprehensive evaluations of habitat quality and biological communities and collected surface water, sediment, and biological samples to determine how the concentrations of mercury and other chemicals varied over time. Sample results from the South River were compared to results from portions of the North River, Middle River, and South Fork of the Shenandoah River. Although mercury concentrations are higher in the South River than in the other rivers, the biological communities and habitat quality are similar.

The Phase I study also documented dramatic, historical improvements in South River water quality, which is likely due to environmental legislation like the Clean Water Act. Virginia Polytechnic Institute researchers found results from a 1970 ecological study that showed that domestic and industrial waste discharges caused oxygen depletion in the water, which severely reduced the number and diversity of aquatic organisms. For example, only two species of invertebrates were found near the 2nd Street Bridge in Waynesboro during the 1970 study. In contrast, Science Team members found 30 species of invertebrates at the same location during the 2007 Phase I study. Although the South River faces environmental challenges in the form of mercury and other stressors, the ecological health of the river appears to have improved over time.

The Phase I study also was performed to identify areas where mercury enters the South River. This was a difficult task because most of the mercury does not enter the river from a pipe or other "point source." However, collecting surface water and sediment samples at consistent locations every month for one year allowed Science Team members to compare mercury concentrations between locations and see how changes in the environment (e.g., water temperature, flow rate) affected the concentrations. Results showed that the majority of mercury appears to be contained in specific areas of the South River located between Waynesboro and *(continued on page 3)*

TechCorner: Phase I Ecological Study
(continued from page 2)

Crimora. The exact sources have not yet been identified, but Phase I study results suggest that much of the mercury is present in a number of small features such as eroding banks and mud deposits along the river. One area of mercury science that is not well understood is how mercury is transformed into methylmercury, which is the form that fish accumulate in their tissues. Science Team studies are currently underway to study how mercury is transformed into methylmercury in the South River.

At the end of Phase I, the Science Team will select study and reference areas for Phase II. Phase II will involve measuring potential impacts on the environment at areas where mercury enters into the river and areas within the river where methylmercury, the dominant type of mercury in fish tissue, enters the food web. Phase II studies will focus on determining mercury impacts on ecological receptors, such as birds or aquatic insects. A substantial amount of work is already being performed by Science Team members to determine the impacts of mercury on a wide range of organisms, including reptiles, amphibians, birds, and bats. By the end of Phase II, the Science Team will have completed one of the most comprehensive studies of mercury transport and effects on a natural system.

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

From the Team…
Spiders a Key Link for Understanding Mercury in Birds

The bird research team that has been studying mercury in birds along the South River since 2005 has detected mercury levels in several songbird species, including wrens and vireos. This result was surprising because many of the songbirds were thought *not* to have an exposure to mercury, unlike fish-eating birds like kingfishers and loons. The team has been trying to determine why these birds that live in the forests and pastures along the river have mercury levels similar to fish-eating birds.

In 2006, the bird crew focused on the origins of the songbird mercury by collecting samples of the bugs that songbird parents brought to their nestlings. While this approach was much more complicated than sampling insects with nets and traps, it ensured that the samples collected were the actual food eaten by the birds. The bugs eaten by bluebirds and wrens were comprised equally of three types of invertebrates: spiders, grasshoppers, and caterpillars. The team determined the total mercury contents of these prey items, and results showed that spiders had much higher mercury levels than the others. In fact, total mercury levels from the spiders were similar to the levels in fish brought back by kingfishers.

A spider poses with a caterpillar in the direct mercury analyzer.


Large spiders such as this wolf spider comprise 25% of the diets of songbirds on the South River and provide 75% of their mercury intake.

Spiders are predators, and, like fish, they reside at the end of long food chains that promote the biomagnification of mercury. Even modest levels of mercury in a habitat can result in elevated mercury levels in high-level predators. In 2007, the team turned its focus to whether spiders further from the river may have elevated mercury levels. In 2008, the focus will be on the mechanism by which spiders accumulate mercury that ends up in birds.

For additional information, contact Dr. Dan Cristol at dacris@wm.edu or (757) 221-2405.

Did You Know?
Removal of Small, Obsolete Dams a Growing Trend

More than 500 small dams have been demolished around the country in recent years, mostly because they no longer serve their original purpose and do nothing but hold back water. The increasing trend to remove small, obsolete dams is due to the potential safety hazards that dams pose and recent scientific understanding of the detrimental effects of dams on rivers. Small dams can block or inhibit upstream and downstream fish passage; increase water temperatures; decrease water oxygen levels; obstruct the movement of sediment, debris, and nutrients; and harm wildlife.

The former McGayesville Dam was removed in September 2004.

For these reasons, efforts are underway to evaluate the removal of a few obsolete dams and obstructions in the South River near Waynesboro. Removal of the dams would ensure safe and unobstructed passage for river users and promote a habitat more conducive for coldwater fish species like trout.

Printed on recycled paper

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

South River Science Team
Attn: Kathy Adams, Technical Writer
508 West Main Street
P.O. Box 1326
Waynesboro, VA 22980

CONTACTS:

Virginia Dept. of Environmental Quality
Don Kain, (540) 574-7815
dgkain@deq.virginia.gov

Virginia Dept. of Game and Inland Fisheries
Paul Bugas, (540) 248-9360
paul.bugas@dgif.virginia.gov

Virginia Dept. of Health
Doug Larsen, (540) 332-7712
douglas.larsen@vdh.virginia.gov

DuPont
Mike Liberati, (302) 892-7421
michael.r.liberati@usa.dupont.com