Keeping you up to date on South River Science Team activities Summer 2007

At A Glance:
Spring Fish Sampling Conducted and Expanded

Since the 1970s, the Virginia Department of Environmental Quality (VADEQ) has been collecting fish from the South River and the South Fork Shenandoah River for mercury analysis to (1) help refine its knowledge of the spatial and temporal trends of mercury concentrations in fish and (2) provide current data to allow the Virginia Department of Health (VDH) and VADEQ to assess the risk to people eating the fish. You have probably seen the warning signs posted in English and Spanish at all public parks and landings from Waynesboro to Front Royal. These warnings are a result of these sampling efforts.

The VADEQ and Department of Game and Inland Fisheries (DGIF) have completed the spring 2007 fish sampling. From 1990 to 2005, fish were sampled every three years. In the future, the VADEQ intends to sample fish every five years, which should be adequate to provide sufficient data without overharvesting the fish population. The target species sampled are smallmouth bass, redbreast sunfish and suckers. Channel catfish are collected from stations where they are plentiful, and trout are collected from Waynesboro and Grottoes where they are stocked. Sample results show that trout are not contaminated.

This year, histopathology was added to the sampling effort at selected sites to gain a better understanding of the fish kills that have occurred in the North and South Forks of the Shenandoah Rivers. The causes of these fish kills, which have occurred each spring since 2004, remain a mystery. Scientists from the United States Geological Survey (USGS) Fish Health Laboratory in Leetown, W.V., are analyzing samples of blood, liver, muscle tissue, gonads and other internal organs. The fish will also be analyzed for parasites, pathogens (viral and bacterial) and diseases.

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:
Mercury Levels in South River Fish: Why Aren't They Declining?

The approximate 20 year span of mercury use at the former DuPont plant in Waynesboro started in 1929. Mercury use was stopped in 1950, and the discovery of elevated mercury in South River fish tissue occurred in 1976. Studies conducted in the early 1980s predicted that fish tissue concentrations would decline naturally, but it was apparent by 1999 that mercury concentrations in fish tissue were not decreasing. The South River Science Team was formed to address this concern.

Mercury is difficult to control in the environment because very small amounts can result in high concentrations in fish. Some of the mercury can be converted by bacteria to a form that is readily taken up by algae and other simple life forms. As the algae are eaten by predators, such as insects and zooplankton, the mercury is absorbed over the lifetime of the organism, resulting in higher concentrations in the predators than in the prey. This process, called bioaccumulation, occurs all of the way up the food chain. As a consequence, the largest, oldest and most predatory fish, like largemouth bass, have the highest mercury concentrations. Mercury also lasts a long time in the environment, and mercury that was released historically can still cause problems.

Ecological team members count critters and sample fish and crayfish to help identify where mercury may be entering the food chain.

The Science Team has been investigating whether ongoing sources of mercury could be preventing fish tissue mercury declines. Dr. James Pizzuto, a fluvial geomorphologist at the University of Delaware, has been studying how the South River interacts with the floodplain and transports sediment. Dr. Pizzuto has determined that higher rates of soil loss due to agricultural practices in the early part of the 20th century created floodplain deposits in certain areas of the river, which are now being eroded and are acting as sources of sediment and potentially mercury to the South River. To identify specific sources of mercury, the geomorphology study continues to focus on the changes that occurred in the South River during the time mercury was used in Waynesboro. The geomorphology study results influence the design and interpretation of other Science Team studies.

An ecological characterization of the South River is also underway. It is designed, in part, to identify sources of mercury to the river and the food chain. A primary component of the study includes sampling during normal-flow and storm-flow river levels to identify portions of the South River that contribute mercury. The ecological study also involves measuring mercury levels in crayfish, fish, aquatic insects, clams and plants to identify areas where mercury may be entering the food chain. The first year of the ecological study was recently completed and data are currently being integrated with the findings of the geomorphology study. Other researchers are studying specific mechanisms by which mercury could enter the South River, such as through soil or groundwater.

In a parallel and coordinated effort, Dr. Michael Newman of the Virginia Institute for Marine Science is studying how mercury is accumulated by higher trophic level fish, like smallmouth bass. Collectively, these studies will lead to a greater understanding of mercury bioaccumulation in the food chain and will help address why mercury levels in fish have not declined.

For more information about the mercury levels in South River fish, contact Mike Liberati at (302) 892-7421.

From the Team…
Univ. of Delaware Surveys Riverbank Using LIDAR

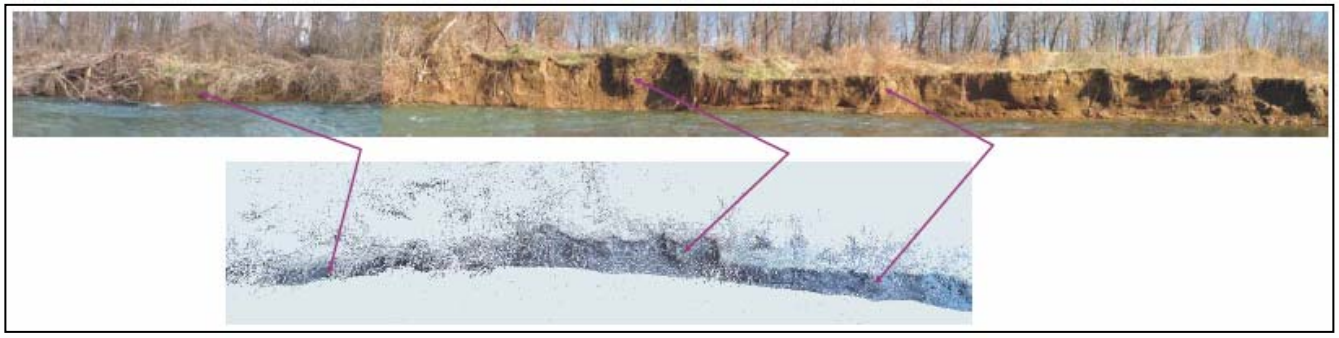
Investigations of bank soils along the South River have identified a number of areas with elevated concentrations of mercury. In some of these areas, the South River is eroding its banks, providing a pathway for mercury to enter the river. The South River Science Team has investigated many potential sources for input of mercury along the South River. The process of bank erosion appears to be a significant ongoing source. Understanding where bank erosion is occurring and documenting how fast the banks erode under different conditions is necessary information needed to develop management plans designed to lower mercury concentrations in the river.

Drs. Jim Pizzuto and Michael O'Neal of the University of Delaware have been studying bank erosion along the South River from Waynesboro to Port Republic for the last two years. They completed a detailed study of aerial photographs from 1937, 1957, 1974 and 2005 to document rates of bank erosion during the last 70 years. These studies provide valuable information on historical erosion rates, but they do not provide present rates of bank erosion.

To measure ongoing bank erosion rates, the team is using a unique laser technology called tripod mounted LIDAR (LIght Detection And Ranging). A pulse of laser energy is aimed at the bank; once the pulse hits the bank, it is reflected back to the instrument. The time required for the round trip is used to determine the distance from the bank to the surveying instrument with great precision. The LIDAR system can survey long sections of the bank rapidly and in remarkable detail. When the LIDAR survey data are plotted as dots, the coverage is so complete that the survey "image" actually looks like a photograph (see LIDAR survey example below).

The team has selected approximately 25 locations along the South River between Waynesboro and Port Republic for bank erosion monitoring using the LIDAR system. At each site, high-resolution Global Positioning System (GPS) receivers provide accurate location information for all the surveyed points.

The illustration below provides an example of two LIDAR surveys from the same site six months apart (in January and June 2006). Each bank survey identifies the detailed topography of the bank, *(continued on page 3)*



Example comparing a LIDAR survey (bottom) with an oblique photograph of the bank (top) downstream of the sewage treatment plant

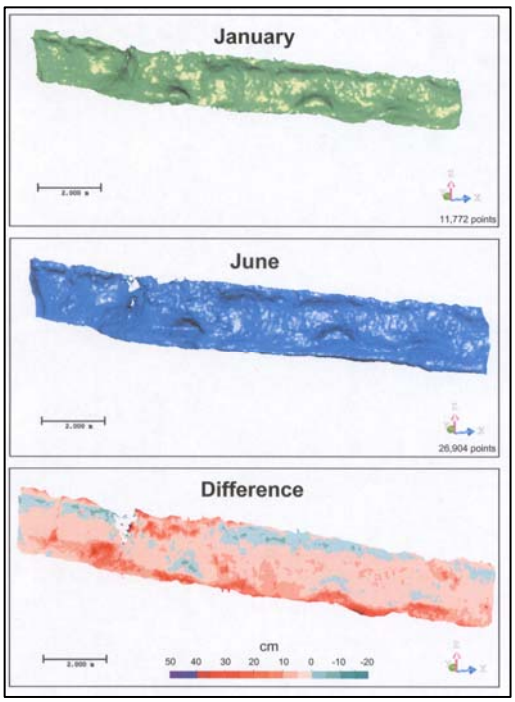


Illustration of the differences between two LIDAR surveys performed six months apart

From the Team: LIDAR Survey
(continued from page 3)

including overhanging areas near the top of the bank and "holes" eroded into the face of the bank. The bottom image shows the differences between the two surveys. The blue areas represent the amount of bank erosion that occurred. The results suggest that 10 to 20 centimeters (about 4 to 8 inches) of erosion occurred, primarily along the top of the bank and also in the two large holes near the base of the bank. Large areas of the bank (those colored pink) show little or no erosion. Note that the red areas at the base of the bank suggest deposition, but this is not a real finding. In fact, the river water level was higher in January than in June so that the laser "saw" more bank in June.

When these surveys are completed, the team will better understand how bank erosion is supplying soil material to the channel of the South River.

For more information, contact Dr. Jim Pizzuto (University of Delaware) at (302) 831-2710.

Did You Know?
Fish Consumption Advisory Not Unique to South River

The fish consumption advisory for the South River is one of six advisories in effect on Virginia waterways due to elevated mercury levels. The other five advisories pertain to all or parts of the North Fork Holston River, Lake Gordonsville (also known as Bowlers Mill Lake), Pamunkey River, Mattaponi River and Herring Creek. Virginia is not alone when it comes to fish consumption advisories for mercury. Based on the Environmental Protection Agency's (EPA's) National Listing of Fish Advisories for 2006, there are 3,080 advisories for mercury in the U.S., an increase of 398 in a year. According to the EPA, the increase in advisories is not because contaminant levels in fish are increasing, but rather that states are sampling waterbodies that were previously untested. In fact, the EPA estimates that U.S. mercury emissions have declined by almost 50 percent since 1990. For more information about fish consumption advisories, visit **http://www.epa.gov/waterscience/fish/advisories/2006/index.html#synopsis**.

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