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FOSR Laboratory  
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### The Spawning Ritual of the Smallmouth Bass

I was out on the river at the very end of April with Jeff Kelble, the Shenandoah Riverkeeper. We were with a film crew that was rolling tape for a documentary they're producing about the Potomac River. Much of the day was spent scouting smallmouth bass "nests" for the presence of eggs. We found lots of nests, most with a large male guarding them, but we didn't see a single nest with eggs.

Jeff told us about the whole spawning cycle. Most years, near the end of April, male smallmouth move to the area they've selected for nest preparation, a site usually protected from the current with a rocky bottom. The male starts by sweeping away any sand or silt from the spot, using his tail like a broom, to expose fist-sized rocks on the bottom. He often uses his whole body to do this, not just his caudal fin. Since both the water levels and the flow dynamics change in the river, males will often sweep several nests and then either select the one that attracts the females or abandon those they can't keep clean, but they ultimately select one nest and defend it for the rest of the spawn.

We don't know how river smallmouth pair up, but as the female's eggs ripen she will approach the spawning areas and select a nest site. As with many animals, it's customary for the largest, strongest male to attract the most females to his nest. Then there is the dance. When the female's eggs are ready to be laid, the male will court her, corral her into the nesting area and perform a ritual of rubbing and flapping against her side, which likely causes the release of her eggs, which he fertilizes upon release.



Spawning females may have several batches of eggs. Eggs can ripen progressively through the season, which increases the likelihood that at least one batch will be ready when river levels are conducive to spawning. Eggs that ripen when river conditions are poor will end up getting absorbed by the female.

The eggs that are released stick to the sides of rocks within the nest. The female fish then go back to their normal lives, while the males spend the next two weeks guarding the nest from predators. Other fish, such as darters or sunfish, will eat the eggs if they can get to them.

Trophy bass fishermen like to tout this a time to catch big fish due to the aggressive nature of the males; but to insure the propagation of this magnificent game fish, I urge you to leave the big males and the spawning beds alone. The male has enough to do. When not chasing off nest raiders, he has to continuously sweep and fan the nest to make sure the eggs have a constant supply of fresh water and keep the nest from getting silted over. If he fails, the eggs quickly develop fungus and won't mature. It's a two-week process from beginning to end.

The eggs gradually turn into "fry," which Jeff describes as an egg with a head and tail. The egg becomes the yolk sack that supplies the baby fish with food until it's large enough to forage. The brood male is swimming around like crazy at this point guarding the fry, and the only thing he eats during the "spawn" is the predators he catches trying to steal the fry. After they are fully formed, the young smallmouth "swim up," which means they go to the surface and begin to eat microscopic plankton and bugs on their own.

It was a really fascinating trip, but a little frustrating because Jeff's seasoned eyes could see the nests quite easily, and the fish guarding them, but I had a little trouble. I learned a lot, though, and got to spend an absolutely breathtakingly beautiful day on the river. I would urge all of you to get out and enjoy our river.

***George L. Ohrstrom, II President***

## Treasurer's Report, Bernard C. Nagelvoort

For our most recent fiscal year end, as of December 31, 2012, the Friends of the Shenandoah River's cash position was \$108,145.95, an increase of \$5,789.35 from its position on December 31, 2011. Total income for the year 2012 was \$129,868.71 versus \$106,475.58 in 2011 with expenses of \$124,079.36 in 2012 versus \$121,661.33 in 2011. The significant difference in income for 2012 was a contribution from the George L. Ohrstrom, Jr. Foundation of \$30,000.

As of July 31, 2013, our cash position was \$106,009.85. Our budgeted income for 2013 is \$108,775 with 2013 expenses budgeted at \$135,815.

While the budgeted deficit for 2013 is \$27,040 and is impacted by several unusual items including \$10,000 for vehicle replacement, we have not taken into account potential and necessary substantial income from the special fundraising effort currently being undertaken. We anticipate this program raising \$30,000 this year and have received \$16,800 as of this report with a pledge of an additional \$5,000 in October. Appeal letters soliciting support from a much broader list of potential contributors is scheduled for September.

The Friends of the Shenandoah River is involved in a substantial review of its monitoring program with the purpose of determining how the program can more effectively assist in the achievement of water quality improvement in the Shenandoah River watershed. A major undertaking is the quantification of the loads of nitrogen and phosphorus to the River system from each County in the watershed utilizing US Geological Survey flow data.

At the same time, we will be considering a revision of our monitoring sites to provide sharper focus on substantial sources of nitrogen and phosphorus, the two nutrients contributing to excess algae and vegetative growth in the main segments of the River system as well as the Chesapeake Bay. We need to encourage the proper use of such basic fertilizer elements in agriculture practices to retain them on the land where they produce valuable agriculture products. Minimal excesses must be allowed to reach surface waters directly and through migration to groundwater where they are destructive.

Likewise, identification of urban sources of excessive nitrogen and phosphorus reaching surface waters is also necessary for the achievement of clean and safe water in our rivers and streams for municipal drinking water, healthy recreation activities and safe industrial uses.

Please keep our budget in mind as you read this newsletter. Our efforts to help provide clean water for ourselves and for future generations depends on strong public financial support.

\*Copies of the FOSR's financial statements can be requested by emailing the FOSR Treasurer at [friendsoftshenandoahriver@gmail.com](mailto:friendsoftshenandoahriver@gmail.com)

If you would like to join the team of volunteer water monitors, assist in the lab or in another way please contact Karen Andersen at [friendsofshenandoahriver@gmail.com](mailto:friendsofshenandoahriver@gmail.com) or (540) 665-1286.

To support the Friends of the Shenandoah River in their efforts including the long-term volunteer water quality monitoring program, please send donations to:

**WE ALL LIVE DOWNSTREAM**

Friends of the Shenandoah River  
Attention: Karen Andersen  
1460 University Drive  
Winchester, VA 22601

## **A Snapshot of Analyses of Spring Water in the Shenandoah Valley by Wayne Webb**

### **SAMPLING DESIGN**

FOSR volunteers are sampling spring waters in the Valley to document nutrient concentrations (N and P) and bacterial density (E. coli) from two sets of springs in the karst regions of the valley. One set includes five springs located in or near areas where biosolids have been applied to the land as fertilizer and another set of five are at substantial distance from areas of biosolids application. The project focuses on springs in the karst areas of the valley because most farming and urban areas of the Valley are on the karst land. The project was launched in February of this year and will consist of six water-quality monitoring collections that will conclude in October 2013.

Hydrologic measurements by the USGS shows that 20 to 70 % of the water in the streams originating in karst land comes directly from springs and only about 3 to 5 % of precipitation on the karst land contributes to overland runoff to streams. (Nelms, D.L., and Moberg, R.M., Jr., 2010, Hydrogeology and groundwater availability in Clarke County, Virginia). Of precipitation, 95% infiltrates the soil surface. Then 2/3 of that evaporates and transpires to the atmosphere and 1/3 results in stream flow. The stream flow 1/3 of precipitation transports nitrate to the streams. For example look at FOSR results from some of the streams that are originate on 100% karst land. Sample sites FC02, Spout Run, and FC18, Chapel Run, in Clarke County consistently yield water containing little more than 2 mg/L nitrate, <http://www.fosr.org/maps/>. The concentration of nitrate in Spout and Chapel runs decrease with increasing stream flow suggesting that the source of nitrate is from the ground water.

This project collects the spring samples at base flow, directly from areas where water is welling up in the spring and before it travels more than 10 feet in the open channel to be sure that the water being analyzed is coming from ground water and not from other sources.



### **RESULTS AND CONCLUSIONS**

The results of the first 3 of 6 samplings show similar concentrations of all measured parameters from one time to the next. Nitrate concentrations in spring-waters near biosolids application areas range from about 3 to 10 mg/L whereas spring-water collected from areas distant from biosolids contain a little less than 2 mg/L to a little more than 3 mg/L. The yield of nitrate depends on the flow of the spring and ranges from 2 to 155 pounds per day as N. There is no observable difference in the very low ortho phosphorus or total phosphorus concentrations between areas.

To date E. coli densities are lower in spring-waters near the biosolids application areas ranging from <1 to 12 near and 1 to 71 away. All the springs yield water with dissolved oxygen concentrations from 4 to 8 mg/L and are all about 12 to 13 degrees C.

The importance of this project is that it identifies a line of evidence that, in the Shenandoah Valley, the nitrogen getting to the Shenandoah River comes in large measure from ground water. Thus, management practices that help reduce nitrogen application to the land are going to be the most effective in helping to reduce the nutrient yield of the Shenandoah Valley to the Chesapeake Bay.

This project is being conducted in cooperation with Clarke County, FOSR and VA DEQ. Funding for this project is provided by the Chesapeake Bay Restoration Fund Advisory Committee and Virginia Department of Environmental Quality through grants secured by Clarke County.



## Good News for Friends of the Shenandoah Valley River System *by Bob Luce*

In July, The South River Science Team (SRST) sent out for review to its more than 100 members a draft proposal with the title “Remediation of Mercury in the South River and a Segment of the South Fork of the Shenandoah River.” Following review, the document will be submitted to Natural Resources Defense Council (NRDC) and the Sierra Club (SC) to fulfill a consent agreement. This agreement also required an extensive study, recently completed, of the consequences that mercury brought about for biota in the South River region.

NRDC and the SC would not enforce the remediation measures discussed in the proposal. However, the proposal is significant for two reasons: it serves as a blueprint for an actual remediation program under **Resource Conservation and Recovery Act (RCRA)** regulations to be administered by Virginia Department of Environmental Quality and it also signals a major change in emphasis by the SRST. Since 2001, SRST has focused its efforts to find out where, how much, and in what forms mercury exists in the South River environs. Now “how to” has been added as a prime function and so engineers are playing increasingly more prominent roles.

The site conceptual model has quantitatively identified stream banks and floodplain sediments as the main sources of mercury to the South River. The primary remediation tools are to be bank stabilization and carbon (biochar) adsorption. Pilot studies have been undertaken to refine how and where these will be implemented. Remediation will be conducted in stages. The first will be the two-mile reach starting at the DuPont (now Invista) plant site in Waynesboro.

Short- and long-term monitoring will be key in assessing results and guiding future actions. Adaptive management tools will govern the evolution of the remediation; risk analysis using Boolean mathematics will play a part as well. Meanwhile, geochemical and biochemical studies will continue to see if they can supplement the primary tools.

The following task teams within the SRST have been formed this past year for the purpose of refining the remediation program:

- remedial options
- monitoring
- human exposure
- program integration of regulatory and legal drivers

Remediation design is scheduled for 2014; implementation commencement is scheduled for 2015.

The Friends of the Shenandoah River has been the citizens group most involved with the SRST since its inception in February 2001. Meryl Christiansen began this association at the earliest meetings. So FOSR members especially should celebrate the above developments to make our river healthier. We have an additional benefit—the mountain of excellent research that is concentrated on the South River pretty much applies to the Shenandoah River as well! Look at the website: <http://southriverscienceteam.org/>. A password is no longer required.



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**We Welcome Urbie Nash to the Friends of the Shenandoah River Board of Directors**  
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Urbie retired in 2007 after 34 years as a professional environmental engineer. He has a bachelor's degree in civil engineering and a master's degree in environmental engineering from Virginia Polytechnic Institute and State University. During his professional career he worked in industrial and municipal water and wastewater treatment plant design, construction and operation. He also was a project and program manager on multimillion dollar EPA, US Navy and private contracts for the investigation and clean-up of hundreds of hazardous waste sites. Most of his work experience was with large, multiple-delivery order environmental programs that included technical analysis, environmental compliance, site characterization and investigation, remedial design, and remedial action services in the hazardous waste, solid waste, water, and wastewater fields. He managed and provided engineering expertise for feasibility and treatability studies, engineering design, construction, and operation of a wide range of industrial municipal and groundwater treatment systems.

Urbie has been heavily involved in professional and volunteer conservation organizations for 40 years. He is past president of the Shenandoah Valley Chapter of Trout Unlimited, Past President of the Virginia Council of Trout Unlimited, and past member of the Trout Unlimited National Board of Directors and member of the National Executive Committee. He is also a past member of the State of Virginia Water Plan Advisory Committee, past member of the Virginia Polytechnic Institute and State University Department of Forestry and Wildlife Advisory Committee and past member of the Upper North River Water Plan Advisory Committee, past president of the Unitarian Universalists Fellowship of Waynesboro, past president of the Riverfest Committee and a member of the Invista Citizens Advisory Committee.

He presently serves as chairman of the South River Steering Committee, a group of local volunteers focused on restoring a trout fishery in the South River near Waynesboro, Virginia and on the executive committee of the Virginia Council of Trout Unlimited. He is also presently the chairman of the City of Waynesboro's Stormwater and Flood Control Commission.

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**Are you the missing puzzle piece to help the Friends of the Shenandoah River be successful in our mission to preserve and restore the aquatic environment of the Shenandoah River and its tributaries.**

**Your talent, ideas and contributions are needed to help us strengthen the organization and impact decision makers and assist the public in being stewards of the Shenandoah River!**

**For further information please contact us at  
540.665.1286 or  
friendsofshenandoahriver@gmail.com**

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