

**Angler Survey  
South River – Upper S. Fork Shenandoah River  
Augusta and Rockingham Counties, VA  
April – October 2005  
F-111-R-13**

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Billy Flint and Pete Barlow survey the South River

## Overview

**Purpose:** The South River Science Team (SRST) determined the need to quantify use, effort, catch, and harvest in South River through an interview-driven angler survey during the 2005 fishing season. Such a survey had never been conducted on this body of water, so the need to attain baseline information regarding aquatic recreation was evident. This report captures some of the attitude toward fishing, knowledge of the consumption advisory, as well as capturing important angling statistics for fisheries management purposes.

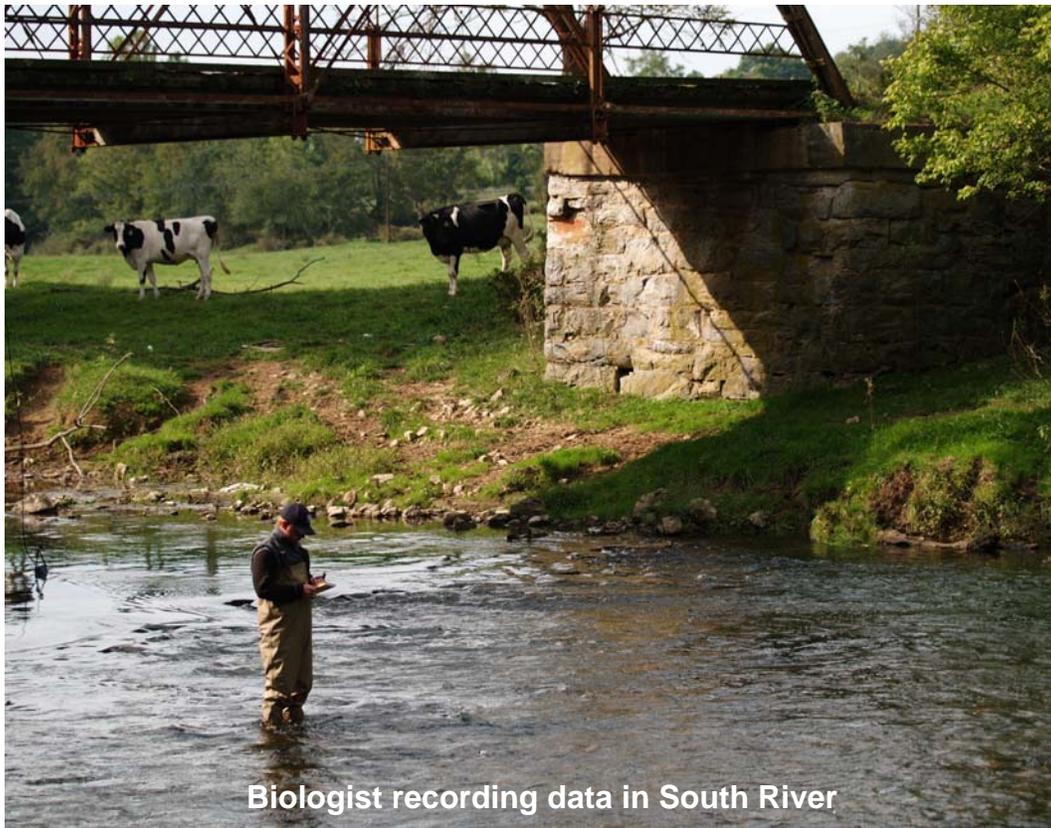
**Background:** The South River watershed has played an important part in the cultural, historical, recreational, and economic growth of Waynesboro and eastern Augusta County. A bustling waterfront economic hub developed in the 1800's at Port Republic, and the massive springs and aquifers that underlie the western toe of the Blue Ridge Mountains supply vast quantities of water for commerce, agriculture, development, and recreation. The primary recipient of these springs and mountain runoff is the South River. Its origins are in the mountain range southwest of Waynesboro. Native trout streams such as Coles Run, Mills Creek, and others supply cold water to the upper reaches of South River near Stuarts Draft. Back Creek, the largest tributary to enter South River upstream of Waynesboro, supports a stocked trout fishery and a popular recreational destination: Sherando Lake. There are 13 flood control dams distributed throughout the Big Levels area near Stuarts Draft. The watershed upstream of Waynesboro can be described as low-gradient, meandering, and spring-fed. Certain reaches of upper South River lend themselves to coldwater fisheries restoration. As South River enters Waynesboro, the gradient increases and large springs continue to feed the main stem. Waynesboro is home to industrial development, some of which are still viable (Invista) and several which have closed their doors over the years (Compton, Genecom). Industrial effluent has plagued the quality of South River's water over time, but stricter standards and better technology has ushered in a new era of improved water quality. In response to a cleaner aquatic environment, the City of Waynesboro, Trout Unlimited, and the Department of Game and Inland Fisheries (DGIF) established the first delayed harvest trout fishery in the Commonwealth of Virginia. From the DuPont footbridge downstream to North Park, catchable rainbow and brown trout have been stocked three times a year since 1989. Anglers are required to release their catch from October 1 through May 31, and may take home a limit of six fish during the summer months. In 1997, DGIF began stocking catchable trout from Grand Caverns Park through Grottoes. Subsequently, the Town of Grottoes has developed a boat landing and a town park and has hosted an annual childrens fishing day. Table 3 summarizes fishing regulations and advisories for the survey area in this report.

In 2000, the South River Science Team was formed to focus on the persistent presence of mercury in fish tissue from South River. The goal of the SRST is to determine the pathway(s) of environmental mercury into fish tissue, mitigate the pathways, then remove South River from the Commonwealth's list of impaired streams. The SRST has invested

significant manpower and capital into understanding the persistence of this metal in the aquatic environment, and part of understanding the problem is fishing and fish consumption. Since an angler (creel) survey had never been undertaken on this river, DuPont, James Madison University (JMU), and DGIF embarked on a cooperative project in spring, 2005 to obtain information regarding the recreational component of South River.

**Design:** A stratified “roving” survey was picked to best obtain the data we needed. The primary reason for choosing a roving survey over an “access” survey was that not many developed canoe/boat/kayak launch points are available for the area we were interested in covering. The roving survey engages anglers by clerks in kayaks when floating from point A to point B. River users are asked a set of questions (Figure 1), given a fish consumption advisory card, and thanked. Any fish caught and kept was identified and measured. The survey itself was split into several strata. Days of the week, river sections, and time of day (morning, mid-day, and evening) were randomly selected using non-uniform probabilities to ensure statistical validity (Tables 1 and 2). To expand the empirical data, we used a Statistical Analysis System (SAS) program, designed by fisheries consultant Steve Malvestuto.

It was determined that the survey would cover the area from Constitution Park in Waynesboro to Island Ford, on the South Fork Shenandoah in Rockingham County. This river reach covered 34 miles of river and was divided into 7 sampling units, ranging from 4.2 to 5.8 miles in length. The survey began on April 23, 2005 and concluded on October 15, with an average of 14 days sampled each month, including weekdays and weekends. An example of the interview form is included in the appendix of this report.



## Results

**Days on the Water:** Figure 1 depicts the number of days spent by our survey team each month from April – October, 2005. July was most heavily sampled, with 19 trips and both April and October had a limited number of samples. Our survey did not get started until late April and the design of the survey only included until mid-October. During the six month period, 129 angling party interviews were conducted and 40 recreational (other than fishing) party surveys were documented. A total of 585 individuals were counted; 261 were fishing and 324 were enjoying other forms of water-based recreation.

The survey team covered seven river reaches (Figure 3) of varying distance. The most intensely surveyed reach was from Waynesboro to Dooms (21 times). This occurred because it was assigned a higher probability of encountering river users, due to the delayed harvest trout fishery near Constitution Park. Similarly, the reach between Grand Caverns and Port Republic was covered 17 times. This again was due to the chance of getting interviews in an area stocked with trout. The least sampled areas were from Crimora to Wesley Church (10 times) and from Port Republic to Hangman Run (10 times). In total, the survey team spent 96 days on the water. Only one scheduled sample date was cancelled due to high water.

**River User Characteristics:** The average river user on South River in 2005 was male (72%), Caucasian (77%), and was between 17 and 35 years old. Figure 4 shows the breakdown of ethnic groups that used the river. The next largest were Hispanics (17%), followed by African Americans (6%), and Asians (<1%).

**Anglers:** When asked where their fishing trip originated, 75 % of anglers came from Augusta County, Rockingham County, and Waynesboro (Figure 4). Several fishing parties drove from Harrisonburg and Page Counties, and few from distances such as Virginia Beach. Most fished from the bank (68%), followed by wading (18%), and from a boat (14%). The average fisherman was a generalist, fishing for anything (Figure 5). The next most sought after species was smallmouth bass, followed by trout. A combined 7% targeted catfish, carp, and sunfish. Most (62%) anglers used spinning gear, followed by 31% fishing with bait, 5% with fly rods, and a 2% combination. A majority of 53% used artificial lures (including flies), 38% used natural baits, and the remaining 9% used both. Most anglers (43%) fished South River over 20 times in a year, while 32% came from 1 to 5 times. The remaining 25% visited from 6 to 20 times annually.

**Other Users:** South River and upper South Fork Shenandoah River attract many other types of recreational users other than anglers. This part of the survey was not designed to be expanded like the angling section, so all of the data associated with this report is empirical information. The survey team documented 40 recreational parties and 324 individuals during the study time frame. When asked what sort of activities they were involved with, 30 % said swimming. This was followed by identical percentages (21%) of people who were kayaking and tubing. Fourteen percent of polled recreationists were wildlife watching, 7% were canoeing, and 7% were involved in other activities. It was primarily visited by people living in Harrisonburg, Waynesboro, Grottoes, and Rockingham County. Most users like both the scenery and the fact that its proximity to their homes. Over 50% said that they did not care for pollution problems, including litter. A total of \$2,415 was spent locally on recreating in 2005.

**Fish Consumption Advisory:** One of the main objectives of this study was to glean fishermen knowledge of the fish consumption advisory that has been imposed on South River (downstream of the Dupont footbridge) since 1977. When asked if they keep their catch, only 18% responded affirmatively. Seventy-seven percent said they released what they caught, and 5% do both. When asked if they ate fish, 81% said no. However, 100% of those who kept fish shared them with family or friends.

Seventy-six percent of the fishing public knew about the consumption advisory, but when asked whether they knew what the advisory was about, 50% answered incorrectly (Figure 6). Only 39% knew what the advisory stated, while 11% did not respond or it was not recorded by the survey team.

Asked how they knew about the advisory, 50% got their information off of signs posted along the river, 23% by word of mouth, 11% by newspaper, and 16% by other means.

Other sources for information about the advisory include fishing regulations, websites, or television. Zero information about the advisory came from radio broadcasts.

Of those that released their catch (N = 52), 82% stated that they practiced catch-and-release fishing, while 8% stated it was from the advisory warnings, 8% said their catch was too small, and 2% stated other reasons.

What did anglers like about fishing South River? Over half, 51%, liked the fact that it was close to home. This was followed by quality of fishing (16%). Eight percent fished for the scenery, 15% liked all of the above, and 10% liked it for other reasons. Asked what they disliked about angling in South River, 55% stated pollution and 40% stated other unspecified reasons. Only 3% stated that fishing quality was poor and 2% answered that it was too crowded.

**Angler Expenditures:** Fishermen were asked two questions about their spending habits regarding South River: how much they spent on specific commodities and how much they contributed to the local economy. Figure 7 summarizes the amount, by month, of angling dollars associated with gas, food, bait, lodging, equipment rental, and other items. The highest amount was spent in June, followed by July and May. Bait and gas comprised most of the money spent during the three aforementioned months, followed by food. \$8,700 was spent on lodging during August, and \$2,400 on equipment rental in August. The estimated total spent by South River anglers over seven months in 2005 was \$191,508. Ninety-three percent was spent within 20 miles of the river, further defining it as a local fishery.

**Angling Effort:** Figure 8 summarizes the expanded fishing pressure, by month and species, for South River in 2005. The dominance of blue in the stacked bars depicts the “generalist” approach to fishing on the river. More fishing hours were spent in May than any other month. More hours were spent pursuing trout in April and May, then anglers targeted smallmouth bass in June and July. Approximately 24,371 fishing trips were estimated, with an average of 1.54 hours expended per trip. The total number of fishing hours for the entire survey period was 37,558 hours.



**Catch and Harvest:** The survey crew identified, counted, and measured 84 smallmouth bass that were taken by anglers from South River in 2005. This compares to 56 smallmouth bass harvested from 97 miles of the South Fork Shenandoah River in 1997. The smallmouth bass catch rate (1.6 per hour) from South River was identical to the 1997 smallmouth bass catch rate from the 1997 South Fork Shenandoah River study. For a “small” river with a fish consumption advisory, this is worth noting. Figure 9 delineates the expanded catch, release, and harvest over the survey period for both bank and boat anglers. The red release line mimics the green catch line, with a large peak in the month of September. The overall catch for the entire period was estimated at 68,551 fish. Figure 10 displays the number of fish harvested or released by species. From this survey, it is apparent that smallmouth bass were creel more heavily than any other species. Although 69% of the smallmouth bass were released, our expanded data shows that 11,498 were removed from the river. Sunfish were second to smallmouth bass in terms of number of fish caught (22,458), but 99% of those were released. Two trout sections were sampled during this survey: the special regulation area in Waynesboro and the put-and-take section between Grand Caverns and Grottoes. Trout caught in the Waynesboro area must be immediately returned to the water from October 1 through May 31. So, legal sized trout were available for “taking” for 4 months during this survey in Waynesboro and throughout the entire survey period for Grand Caverns. Despite the volume of trout stocked in both areas, only 3,558 brown and rainbow trout were caught during the study, and 63% of those were released. Trout are the only fish family not affected by the consumption advisory in South River. Stocked trout have been tested and do not remain

in the river long enough to uptake mercury. Largemouth bass and fallfish were caught in smaller numbers, and most of them were immediately released by anglers. Finally, common carp made up the smallest segment (95 fish) of the overall catch, and all of them were released. Figure 11 shows the catch rate (number of fish per hour) by species. Fishermen targeting “anything that bites” were catching over 2 fish per hour, while smallmouth bass anglers were landing over 1.5 fish per hour, and around 1.2 trout were caught per hour. What size smallmouth bass were being taken from the river? Figure 12 captures the frequency distribution of 84 smallmouth bass lengths. Most of the creel bass were between 8 and 10 inches long, with 14 taken between 12 and 14 inches long.

### **Summary:**

- A roving angler survey was conducted on South River (Waynesboro to Port Republic) and on South Fork Shenandoah (Port Republic to Island Ford) from April – October 2005.
- 129 angling party interviews and 40 recreational (other than fishing) party interviews were conducted over 34 river miles.
- The average river user was a Caucasian male between 17 and 35 years old that was from Augusta County, Rockingham County, or Waynesboro. He primarily fished from the river bank and targeted anything that was biting. Spinning gear with artificial lures was the tackle of choice. Most were repeat anglers, using the resource over 20 times per year. Other users were primarily swimming and tubing.
- 77% of anglers released what they caught and 81% said they did not eat fish from the river. Of those that kept fish, 100% shared them with family and friends. Seventy-six percent knew about the advisory, but only 39% knew what the advisory meant. Half of those interviewed knew about the consumption advisory from signs posted by state agencies and most other by word-of-mouth. A large majority of anglers released fish because they follow a “catch-and-release” ethic, not because of the advisory warning.
- Over half of the anglers interviewed fished the South River and South Fork Shenandoah River because it is close to home. Sixteen percent liked the quality of fishing, 8% liked the scenery, and the rest fished it for other reasons.
- 55% of anglers did not like fishing due to pollution issues, while 40% stated other problems they had with not enjoying their experience.
- An estimated \$191,508 was spent by anglers for gas, food, fuel, lodging, bait, and boat rental. Close to 93% was spent within 20 miles of the river, emphasizing the contribution to the local economy. Recreationists contributed \$2,415 to the local economy in 2005.
- Fishing pressure was greatest in April and May for trout and June and July for smallmouth bass. Approximately 1.54 hours were spent per angler for each trip and 24,371 trips were estimated (37,558 hours).
- The total catch for all species was estimated at 68,551 fish. Most fish were released, but the most heavily creel species was smallmouth bass. Expanded data showed that 11,498 smallmouth bass were taken in 2005 from the survey

- area. September was an especially active month for smallmouth bass catch and harvest.
- Trout were caught in modest numbers compared to smallmouth bass. Around 3,558 rainbow and brown trout were caught and 63% released.
  - Sunfish were caught with great frequency (22,458), but 99% of them were released.
  - Largemouth bass and common carp represented a minor segment of the angler survey in terms of catch and harvest.
  - The average length of smallmouth bass harvested was around 9 inches.

**Management Implications:** South River and South Fork Shenandoah River, despite consumption advisories and recent fish kills, are impressive sport fisheries that are enjoyed by the public. Two types of stocked trout fisheries in South River continue to serve the public well and are very popular destinations for local anglers. Rainbow and brown trout continue to provide a source of protein for anglers in the Grottoes area, yet fall outside of the state consumption advisories. The angler survey indicated that a significant amount of smallmouth bass harvest still occurs. Because the average harvest size fell below trophy proportions, it can be assumed that these fish are being eaten. Anglers are aware that there are consumption advisories, but do not necessarily know what they are. Signs seem to be the best venue in getting the word out. A mandatory catch-and-release regulation, or one with a single-fish 20 inch size limit, for South River smallmouth bass might close the loop on fish being taken for consumption.

South River and upper South Fork Shenandoah River fishermen and recreationists generate a substantial income stream to regional vendors. Gasoline, bait, snacks, lodging, and equipment rental at local markets are important economic contributors that are often overlooked by experts. Both rivers are popular swimming, tubing, and boating destinations during the summer months. Pollution issues that concern river users range from litter to fish consumption advisories. Perhaps well-coordinated river cleanup days in the spring would relieve some of these concerns and educate the citizenry regarding mercury issues.

**References:**

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Malvestuto, S. P. 1996. Sampling the Recreational Fishery. Pages 591-623 in B. R. Murphy and D. W. Wills, editors. Fisheries Techniques, Second Edition. American Fisheries Society, Bethesda, Maryland.

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**Figure 1**

**SOUTH RIVER ACTIVITY SURVEY**

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**Interview Form**

*Hello. We're conducting a scientific survey to find ways to improve the fishing and recreation on the South River. Can we ask you a few questions?*

Date \_\_\_\_\_ Interview Number \_\_\_\_\_ River Reach \_\_\_\_\_

Clerk Name \_\_\_\_\_

Weather Conditions \_\_\_\_\_

GPS: Latitude \_\_\_\_\_

Longitude \_\_\_\_\_

Time survey started (military time) \_\_\_\_\_ Time survey ended (military time) \_\_\_\_\_

Number in Party \_\_\_\_\_ Time Period AM MD PM (circle one)

**Males in Party**

Age	African-Am	Caucasian	Hispanic	Asian	Other
<16					
17-35					
36-50					
50-65					
>65					

**Females in Party**

Age	African-Am	Caucasian	Hispanic	Asian	Other
<16					
17-35					
36-50					
50-65					
>65					

If any fish were kept, identify them and count them (only measure SMB)

Species	Length (inches)	Number
Smallmouth bass		

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### Fishing Survey

Fishing from: Bank    Wading    Boat/canoe/kayak    (circle one)

Is this a completed trip?    Yes    No    (circle one)

1. *What time did you start fishing today?* \_\_\_\_\_ (military time)
2. *What type of fish are you hoping to catch?* (a) smallmouth bass (b) trout (c) panfish/sunfish/bream/rockbass/redeye/crappie (d) catfish (e) anything (f) other \_\_\_\_\_
3. *Are you:* (a) spin fishing? (b) bait casting? (c) fly fishing? (d) combination?
4. *Are you fishing with:* (a) natural bait? (b) artificial lures/flyes? (c) both?
5. *What do you do with the fish you catch?* (a) keep (ask questions under "if keep") (b) release (ask questions under "if release") c. combination (ask questions under both "if keep" and "if release")

#### **If Keep...**

- 6a. *Do you eat the fish you keep?* (a) yes (b) no
- 6b. *In general, how many fish from the South River do you eat each month?*  
 (a) \_\_\_\_\_ sunfish/bream (b) \_\_\_\_\_ trout (c) \_\_\_\_\_ rock bass  
 (d) \_\_\_\_\_ musky (e) \_\_\_\_\_ largemouth bass (f) \_\_\_\_\_ catfish  
 (g) \_\_\_\_\_ smallmouth bass (h) \_\_\_\_\_ other
- 6c. *Do you share your catch with family or friends?* (a) yes (b) no
- 6d. *Do you know that there is a fish advisory on this river?* (a) yes (b) no
- 6e. *How do you know about the advisory?* (a) posted signs (b) word of mouth  
 (c) newspaper (d) radio (e) other \_\_\_\_\_
- 6f. *Do you know what the advisory is in this river?* (a) answered correctly  
 (b) answered incorrectly

#### **If Release...**

- 6g. *Do you know that there is a fish advisory on this river?* (a) yes (b) no
- 6h. *How do you know about the advisory?* (a) posted signs (b) word of mouth  
 (c) newspaper (d) radio (e) other \_\_\_\_\_

- 6i. *Do you know what the advisory is in this river?* (a) answered correctly  
(b) answered incorrectly
6. 6j. *How many fish have you released today?*  
(a) \_\_\_\_\_ sunfish/bream (b) \_\_\_\_\_ trout (c) \_\_\_\_\_ rock bass  
(d) \_\_\_\_\_ musky (e) \_\_\_\_\_ largemouth bass (f) \_\_\_\_\_ catfish  
(g) \_\_\_\_\_ smallmouth bass (h) \_\_\_\_\_ other
7. 6k. *Why did you release these fish?* (a) catch-and-release angler (b) health advisory (c) too small (d) already limited out (e) other \_\_\_\_\_
7. *Why do you like to fish the South River?* (a) quality of fishing (b) scenery (c) close to home (d) all of the above (e) other \_\_\_\_\_
8. *In what other areas of the river do you fish?* (a) don't fish in other areas (b) other \_\_\_\_\_  
\_\_\_\_\_
9. *What do you not like about South River?* (a) quality of fishing (b) too crowded (c) pollution (d) other \_\_\_\_\_
10. *How much will your party spend on this trip today? (round dollars)*  
(a) gas \_\_\_\_\_ (b) food \_\_\_\_\_ (c) bait/tackle \_\_\_\_\_ (d) lodging \_\_\_\_\_  
(e) canoe rental \_\_\_\_\_ (f) other \_\_\_\_\_
11. *How much of your expenditure was spent within 20 miles of the river?*  
(a) all (b) most (c) none
12. *How many times per year do you fish on South River?*  
(a) 1 – 5 (b) 6 – 10 (c) 11 – 20 (d) > 20
13. *Where are you from?* City/county \_\_\_\_\_ State \_\_\_\_\_

### Recreation Survey

1. *If you are not fishing, what activity best describes why you are on the river today?*  
 (a) wildlife watching (b) canoeing (c) kayaking (d) swimming (e) tubing  
 (f) other \_\_\_\_\_
2. *Why do you like to recreate in the South River?* (a) scenery (b) close to home  
 (c) both (d) other \_\_\_\_\_
3. *What do you not like about South River?* (a) too crowded (b) pollution  
 (c) other \_\_\_\_\_
4. *How much will your party spend on this trip today? (round dollars)*  
 (a) gas \_\_\_\_\_ (b) food \_\_\_\_\_ (c) lodging \_\_\_\_\_  
 (d) canoe rental \_\_\_\_\_ (e) other \_\_\_\_\_
5. *How much of your expenditure was spent within 20 miles of the river?*  
 (a) all (b) most (c) none
6. *How many times per year do you recreate on South River?*  
 (a) 1 – 5 (b) 6 – 10 (c) 11 – 20 (d) > 20
7. *Where are you from?* City/county \_\_\_\_\_ State \_\_\_\_\_

Table 1. Secondary sampling units with associated sampling probabilities.

Reach No.	Reach Name	River	River Miles	Probability
1	DuPont to Dooms	South	5.0	0.25
2	Dooms to Crimora	South	5.0	0.10
3	Crimora to Wesley Church	South	4.5	0.10
4	Wesley Ch. to G. Caverns	South	5.8	0.10
5	G. Caverns to Port Rep.	South	4.2	0.20
6	Port R. to Hangman Run	S.Fork	5.0	0.12
7	Hangman R to Island Ford	S. Fork	4.4	0.13

Table 2. Time strata with associated sampling probabilities

Time Period	Time on Water	Probability
AM	8:00 am to Noon	0.35
MD (midday)	Noon to 4 pm	0.30
PM	4 pm until 8 pm (or dark)	0.35

Table 3. Sportfish harvest regulations for South River and South Fork Shenandoah River

River Reach	Species	Size Regulation	Daily Creel	Season	Comments
1	Trout	Catch and Release	0	Oct 1-May 31	Trout stocked from Dupont to North Park three times per season
1	Trout	6 inches	6	June 1-Sept 31	Trout can be harvested during summer
1 - 5	Smallmouth bass	None	5	Year round	Recommend no harvest
1 - 5	Sunfish	None	50	Year round	Recommend no harvest
1 - 5	Carp	None	None	Year round	Recommend no harvest
1 - 5	Catfish	None	20	Year round	Recommend no harvest
5	Trout	6 inches	6	Year round	Put-and-take area
6 - 7	Smallmouth bass	Slot limit	5	Year round	No bass between 11-14" Recommend 2 meals/mo
6 - 7	Sunfish	None	50	Year round	Recommend 2 meals/mo
6 - 7	Crappie/Rock B.	None	25	Year round	Recommend 2 meals/mo
6 - 7	Catfish	None	20	Year round	Recommend 2 meals/mo
6 - 7	Carp	None	None	Year round	Recommend 2 meals/mo

