



## 2011 South Fork Shenandoah River Angler Creel Survey

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### Introduction

The South Fork Shenandoah River in northwestern Virginia (Figure 1) is recognized nationally for its smallmouth bass fishery. The South Fork flows north (97 miles) until it is joined by the North Fork Shenandoah at Front Royal, and then continues through West Virginia where it empties into the Potomac River at Harper's Ferry. The Shenandoah River is considered one of the most influential rivers in the Chesapeake Bay Watershed.

The South Fork Shenandoah River has a diverse sport fishery. Smallmouth bass, largemouth bass, redbreast sunfish, bluegill, channel catfish, and muskellunge are the most common species targeted by anglers. Rock bass, black crappie, pumpkinseed sunfish, yellow and brown bullhead, and common carp are also encountered by anglers fishing the South Fork. Only muskellunge are stocked annually by VDGIF to sustain that population.

The South Fork Shenandoah harbors two legacy contaminants that carry a fish consumption advisory from the Virginia Department of Health. The entire 97 miles of the South Fork is under a fish consumption advisory due to mercury that originated from an industrial operation (1920-1950) in the headwaters on South River in Augusta County. The mercury advisory has been in place since 1977 when the mercury was first discovered. The South Fork in the vicinity of the Town of Front Royal (lower 4 miles) is under a fish consumption advisory due to PCBs. These contaminants originated from an industrial operation in Front Royal, and the advisory was put in place in 1989. In addition, since 2005 unexplained fish disease and mortality episodes have occurred across the entire South Fork in the spring months. The location and severity of these fish disease and mortality incidences have not been consistent from year to year. Over the past three years the number of dead and diseased fish being observed has steadily decreased. VDGIF continues to work with fish health researchers in trying to determine the cause of these fish health problems.

The South Fork Shenandoah is a very accessible river for river enthusiasts with 25+ public access points evenly distributed from the headwaters to the mouth. There are also 7 river miles of Shenandoah River State Park in Warren County, and some tracts of George Washington National Forest bordering the river in Page and Warren County. The river is also relatively close to the large population centers of Northern

Virginia and the Washington D.C. metro area. Several large canoe liveries and outfitters operate on the South Fork. For these reasons the South Fork Shenandoah River receives more “human” visitation than any river in the Commonwealth.

VDGIF has a long history of conducting angler creel surveys on the South Fork Shenandoah River. Surveys were conducted in the 1960’s, ‘70’s, and 80’s. Some of these surveys were roving “on-water” surveys and others were conducted by areal flight counts. The early surveys were mainly focused on estimating fishing pressure, and catch/harvest of sportfish. In 1997 VDGIF District Fisheries Biologist Darrell Bowman designed a very extensive angler creel survey of the South Fork and Main stem .Shenandoah. It was a roving (on-water) survey that ran from April 1 through October 31. Areal flights were also used to help validate the accuracy of on-water angler counts. This was an excellent survey that gathered very useful information. In 2005, VDGIF conducted a “Bus-Route” angler creel survey in which a creel clerk spent time at various public access points intercepting anglers as they were coming off the river. Under this method, different lengths of time were spent at numerous access points in one day. Unfortunately, the consultant who designed this survey for VDGIF succumbed to cancer before the survey was completed and the data was never analyzed. In 2008, the South Fork Shenandoah anglers were again surveyed by VDGIF. This time an “Access Point” survey design was chosen. This method consists of a creel clerk being stationed at one public access point for the entire survey day (10 different public access points were surveyed throughout the project). This was the first Access Point survey that had ever been conducted on the South Fork. This type of survey is generally used on lakes and reservoirs where there may only be 1-5 angler access points. We knew that we would be underestimating bank and wade anglers as well as anglers that access the river only from private property. These assumptions became reality as the data from the 2008 survey was compared to the 1997 roving survey. The number of anglers interviewed was ½ as much as the roving survey. While biologists felt confident about some of the information obtained from the 2008 Access Point creel survey, it was decided that future angler creel surveys would follow to design of the 1997 roving survey. This would also assist biologists in comparing trend data over time. You will notice that throughout this report biologists have compared information collected in the 2011 survey to the 1997 and 2008 surveys.

### Methods

The “roving” angler creel survey design was used to count and interview anglers on the river. The 1997 and 2008 surveys showed that the majority of angling pressure on the South Fork took place May through August. Therefore, the 2011 survey ran from May 1 through August 31. VDGIF statisticians determined that valid data could be obtained with surveying only 12 days per month. These days were randomly chosen, with a higher probability being given to choosing weekend days over week days. The 1997 and 2008 surveys covered 11 days per month respectively. The survey day was broken into two 6-hour time periods (AM-9:00am to 3:00pm; PM-2:00pm to 8:00pm). A higher probability was chosen for selecting the PM time period as anglers that had been fishing for several hours were more valuable to interview. Ten (10) river reaches were selected to survey (Table 1). Uniform probabilities were used when randomly selecting survey reaches. All the survey reaches entered and exited the river at public access points. Survey reaches were also selected based on the distance the creel technicians could float in the time period, and also by knowing reaches that anglers often targeted for a daily “float”. Some of

the reaches were identical to the reaches used in the 1997 survey. Two Virginia Tech students were hired as creel clerks and used kayaks (canoe at times) to conduct the survey. Only one river reach was floated per survey day and all anglers encountered were asked a series of interview questions (Appendix 1). The clerks interviewed anglers in boats, wading, and on the bank. Anglers that could not be interviewed for various reasons were counted. Clerks also recorded the number of non- anglers they witnessed using the river during the survey float. These were individuals in canoes, kayaks, tubes, or just swimming/wading in the river. The creel clerks were lucky in that they did not miss any scheduled survey days due to unsafe river conditions. However, they ran the survey no matter under all weather conditions. All interview data was entered into Microsoft EXCEL and SAS was used for statistical analysis.

## Results

Angler effort (fishing pressure) was estimated at 33,384 angler trips for a total of 83,352 hours of fishing pressure (Figure 2). The average trip time spent fishing by an angler was 2.50 hours during this survey. There was roughly 40% less fishing pressure in 2011 compared to 1997 (roving survey). Anglers fishing from boats comprised 54% of the effort in 2011. This has remained unchanged since 1997.

### *Smallmouth bass*

Smallmouth bass were the most sought after species by anglers in 2011 receiving 83% of the fishing effort. This has remained constant since 1997). A breakdown of the species that anglers targeted in 2011 is expressed in (Figure 3). Biologists often look at the catch rate (No. fish caught per hour of fishing) as an indicator of the fishing quality. Believe it or not, but fisheries professionals across the country consider a good catch rate for some sportfish species to be 1-2 fish per hour. The catch rate for smallmouth bass in 2011 = 2.01 bass per hour. This has remained relatively consistent since 1997 (Figure 4). What were the sizes of smallmouth being caught in 2011? An estimated 122,041 smallmouth bass were caught during the 2011 survey. The majority 74.5% were <11" with 20.94% being in the 11-14" range. 5% of the smallmouth caught and released were >14" in length. The sizes and sometimes numbers of smallmouth bass caught by anglers in a given year is often a good "picture" of the fish currently in the population. See (Figure 5) for the size of smallmouth caught in previous creel surveys and then (Figure 6) to see how this relates to the size structure of the bass population measured by biologists through electrofishing. The smallmouth bass fishery in the South Fork Shenandoah could be considered a "catch-n-release" fishery since >95% of the smallmouths caught by anglers are released. 99.3% of the smallmouth caught in 2011 were released. The catch and release ethic is strongly rooted in South Fork anglers as 88% said that they would not harvest a trophy-sized (20") smallmouth nor would they harvest any legal-size bass. This strong release ethic has declined slightly as 95% of anglers indicated they would release trophy and legal-size smallmouth during the 2008 survey (Figure 7). The catch and release practice among bass anglers fishing the Shenandoah River has steadily increased since the 1970's. We also asked smallmouth bass anglers what they would consider being the perfect day on the South Fork. We then made them choose from a series of scenarios indicating the number of fish they caught and the largest smallmouth captured. 41.2% of smallmouth anglers said that their "perfect" day fishing the South Fork Shenandoah would be to catch 5 smallmouth bass with the largest being 20

inches long. This is slight change from what anglers wanted when asked in the 2008 survey. In 2008, the majority (51%) said their perfect day would be to catch 15 smallmouth with the largest being 18 inches long. Smallmouth bass anglers were also asked what they considered to be the minimum size of a “quality-size” smallmouth bass. They were given multiple choices from 10 to >18 inches. The vast majority of smallmouth indicated bass 10-16 inches, with most centering on 12 inches. This is almost identical to the results from the 2008 creel survey.

### *Largemouth bass*

Unlike other smallmouth rivers across Virginia, the South Fork Shenandoah River harbors an excellent largemouth bass fishery. The largemouth bass population has been steadily increasing since the 1970's and currently can comprise 50% of the total black bass population in some reaches of the South Fork. The majority of largemouth bass are found in the deeper pools and impounded pools upstream of dams on the South Fork (of which several were creel in 2011). 1.6% of the overall fishing effort was directed toward largemouth bass in 2011. An estimated 23,213 largemouth bass were caught and released by anglers in 2011. Creel clerks did not interview anyone that indicated that they had harvested a largemouth during the survey. As with smallmouth bass, it appears that the largemouth bass fishery in the South Fork is also predominately catch and release.

### *Sunfish*

Whenever you fish the South Fork Shenandoah River you are usually casting your lure or bait near one of several different species of sunfish. The two most common sunfish species are the redbreast sunfish and bluegill. Abundance of rock bass, pumpkinseed sunfish, and green sunfish is generally lower. The estimated 2011 sunfish catch: redbreast sunfish ( 57,016 ) ; bluegill (7,100) ; pumpkinseed (93) ; rock bass (2,588) ; green sunfish (57). Sunfish harvest was light with 97% being released. Fishing effort directed at catching sunfish was 3.0% in 2011.

### *Channel catfish*

While catfish can be caught during daylight hours, most anglers fish for them after dark when they are more active. Since the 2011 creel survey was only run during the day, the estimates for catfishing pressure, catch and harvest is heavily underestimated. VDGIF has never conducted a creel survey at night predominantly due to logistical and safety reasons. An estimated 5,236 channel catfish were caught during the survey period, with only 8% being harvested. The catch rate for catfish was decent at 0.99 fish per hour. 9% of the overall fishing pressure was directed toward catfish in 2011. As expected, the majority of catfish anglers were fishing from shore.

### *Muskellunge*

VDGIF began stocking muskellunge in the South Fork Shenandoah River over 20 years ago to provide a “trophy” component to the fishery. A muskellunge habitat survey was conducted on the South Fork in the mid 1990's and annually stockings in the best habitat locations have occurred in the past decade. While fish are stocked annually, it is believed that there is some level of natural reproduction occurring.

This belief comes from an increase in muskellunge catches in recent years (reports from anglers to VDGIF) and in VDGIF electrofishing samples. In recent years biologists have started a project to determine the contribution of stocked muskellunge to the population. In 2011, an estimated 168 muskellunge were caught by anglers (all were released). 0.2% of the overall fishing effort was directed toward muskellunge on the South Fork in 2011. It must be noted that the majority of muskellunge data in the 2011 survey is from a single angler that was fishing specifically for muskellunge and that individual had caught and released one fish. The same thing occurred in 1997 with only one musky angler being interviewed. In 2011, all anglers were also asked if they had caught or fished for musky in the past five years. Less than 10% of the anglers interviewed said that they had either caught a musky or fished for musky in the past 5 years on the South Fork. VDGIF also has anecdotal information that fishing for muskellunge has increased in popularity on the South Fork over the last decade. However, the current angler creel survey methods do not provide adequate information for VDGIF's muskellunge management needs. VDGIF is pursuing other ways of gathering muskellunge angler and effort data.

### *Other species*

Other fish species that were caught by anglers in 2011 include: black crappie, common carp, fallfish, white sucker, and yellow bullhead. There was no harvest reported for any of these species. It must be noted that 2.2% of the overall fishing effort was directed toward common carp. That was slightly less than the pressure for sunfish (3%).

### Angler Attitudes

Anglers were asked why they release fish and the majority indicated that they thought it was the "right" thing to do. While the fish consumption advisories were a main reason why anglers did not harvest fish from the South Fork during the 2008 survey (83%), that reason declined in 2011 (46%). On the public health front, the good news is that more anglers indicate that they are aware of the fish consumption advisories on the South Fork Shenandoah. That number has increased from 46% in 1997 to 85% in 2011. However, VDGIF acknowledges that there is night fishing occurring on the South Fork Shenandoah with channel catfish being the main species sought. Channel catfish are generally consumed by these night anglers. However, the 2011 survey (nor any previous surveys) did not estimate the fishing pressure or obtain any information about fish harvest from this segment of anglers. Angler satisfaction with the South Fork fishery was high in 2011 with 88.6% of the anglers interviewed indicating they were either "satisfied, moderately satisfied, to greatly satisfied." This is an increase from the satisfaction level in 2008 when 75% of the anglers were content with the fishery.

### Economic Impact / Angler Demographics

Placing a dollar value on a fishery is extremely difficult. In 2011 anglers were asked how much money they spent on their fishing trip. That would include expenses for gasoline, food, bait, tackle, canoe rental, lodging etc. Based on info collected during the survey it was estimated that total expenditures from the survey = \$1,546,761. This figure probably underestimates the total economic benefit from the South Fork Shenandoah River fishery in 2011. Anglers were also asked what % of the money they spent

for that rip was spent within 20 miles of their location. 71% of the total trip expenditures were spent within 20 miles.

The South Fork Shenandoah River could be classified as a “local” fishery as the majority (80%) of the anglers interviewed were Virginia residents, and also from counties within the watershed (69%). This is extremely similar to the previous surveys in 1997 and 2008. As was mentioned in the introduction, Anglers fishing the South Fork Shenandoah have plenty of public access points along the entire length of the river. 64% of anglers are only using these public access points when fishing the river. This percentage increases significantly when only surveying anglers floating the river via watercraft. Bank and wade anglers tend to access the river through private property more frequently than boating anglers.

The primary intent of this survey was to estimate fishing pressure and other angling information to help fisheries biologists improve management of the fishery resource. However, a secondary objective was to estimate the number of non-anglers that recreate on the South Fork Shenandoah River. Creel technicians were asked to count boats (canoes, kayaks, tubes, jon-boats etc.) and individual people using the river that were not fishing (boating, swimming) each survey day. During the survey period, an estimated 7,069 canoes, 3,253 kayaks, and 6,437 other boats carrying non-anglers used the South Fork during the survey period. Adding individuals observed swimming or wading to the people in boats brought the total estimated number of non-anglers recreating in the South Fork during the survey period to 99,290. This number was generated from creel technicians observing 2,336 non-anglers during the survey. These non anglers were not interviewed by the creel technicians due to time constraints, but one can only imagine the significant economic impact these recreational river users are having on the Commonwealth’s economy. More accurate information on non-anglers recreating on the South Fork Shenandoah River is needed.

#### Summary

The cost of running this angler creel survey was roughly \$8,500. This amount includes gasoline costs (\$1,478.27) for the two Department vehicles used by the creel technicians, and their wages (\$6,759). \$200 was added as miscellaneous expenses for vehicle maintenance, and equipment. Department employee salary costs associated with the survey design, management, and analysis were not included.

After comparing the results of the 2011 “roving” angler creel survey, VDGIF concludes that this survey design provides more realistic information on fishing pressure and associated data than access point survey designs. Future surveys will be using the roving design similar to 2011.

Angler satisfaction was high and catch rates were on average for smallmouth bass in 2011. The majority of anglers fishing the South Fork are local residents, target smallmouth bass, and practice catch and release. Fishing pressure is much lower than in previous decades, but has remained steady since 2008. Smallmouth bass is the fish of choice by South Fork anglers and the majority of bass caught in 2011 were <11”. However, roughly 25% of the smallmouth caught were >11” reflecting the current status of the overall population.

The South Fork Shenandoah River fishery is very important economically to the Commonwealth and localities. Non-anglers that recreate on the South Fork greatly outnumber fishermen. More information about recreational users of the South Fork is necessary before a better estimate of the economic value of this natural resource can be determined.

### Acknowledgements

I would like to thank creel clerks Brandon Fair and Gregory Wright for their diligence, commitment, and professionalism while conducting this angler creel survey. They did an outstanding job! I wish them well in their future endeavors. A huge "Thank You" also goes to Nicole Kmetz, Bridgewater College student, for entering all the raw data into Microsoft EXCEL. She flawlessly entered data from all 300 interview forms in record time. I wish her well in her career pursuits. I would also like to thank Vic DiCenzo, VDGIF Fisheries Biologist / Survey Analyst, for his assistance in the survey design and analysis. This report would not have very useful data without his help. I'm also grateful for the help of Charlie Grady, DGIF/CWF Volunteer, and Henry (intern) for their assistance in running the survey on occasions when Brandon or Greg had a schedule conflict. Lastly, funding for this project was provided by the Sport fish Restoration Grant F-111R.

Table 1. Reaches of the South Fork Shenandoah River surveyed during 2011.

<u>River Reach</u>	<u>Distance (miles)</u>
Island Ford to Elkton	6.9
Elkton to Shenandoah	6.6
Shenandoah to Grove Hill	8.9
Newport to Whitehouse	8.5
Luray Dam Pool	3.0
Inskeep to Bealers Ferry	7.0
Bealers Ferry to Seakford	7.5
Compton to Bentonville	10.0
Bentonville to Karo	8.4
Karo to Riverton	10.0

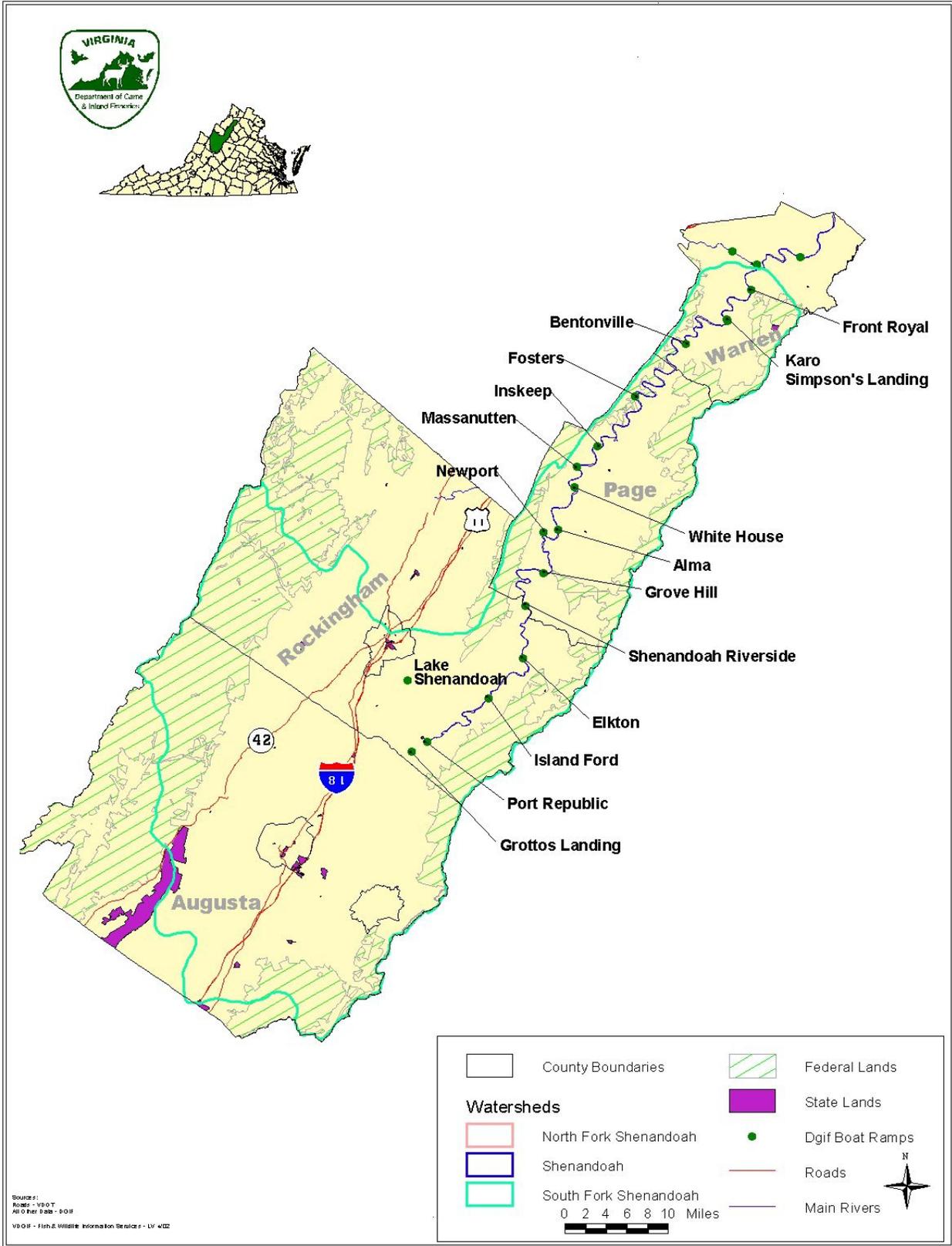


Figure 1. Location map of South Fork Shenandoah River.

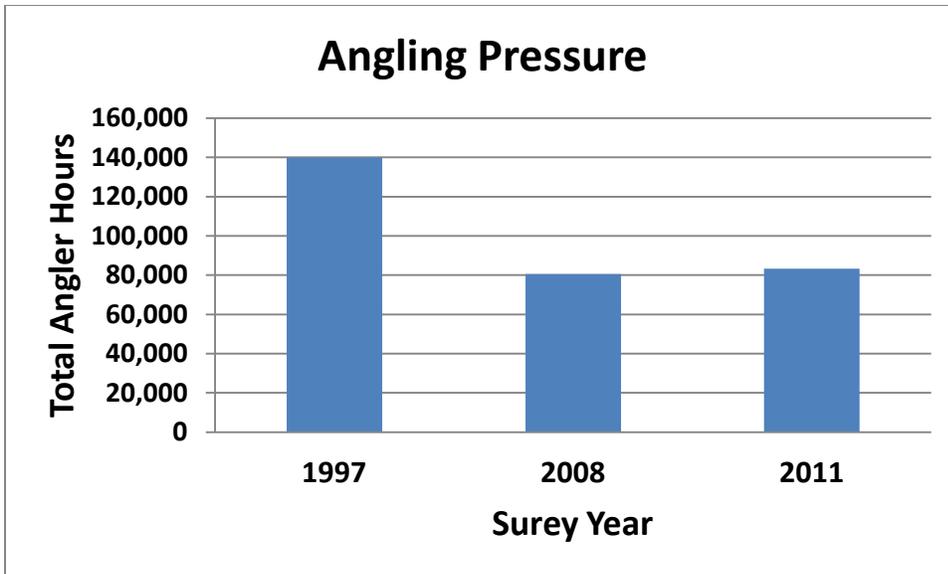


Figure 2. Estimated fishing pressure on the South Fork Shenandoah River.

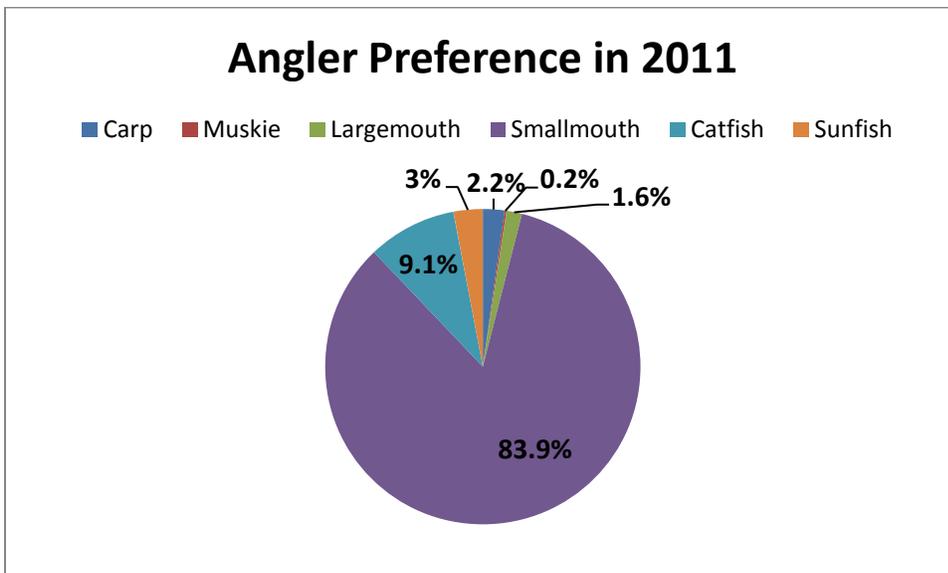


Figure 3. Species preference targeted by anglers on the South Fork Shenandoah River in 2011.

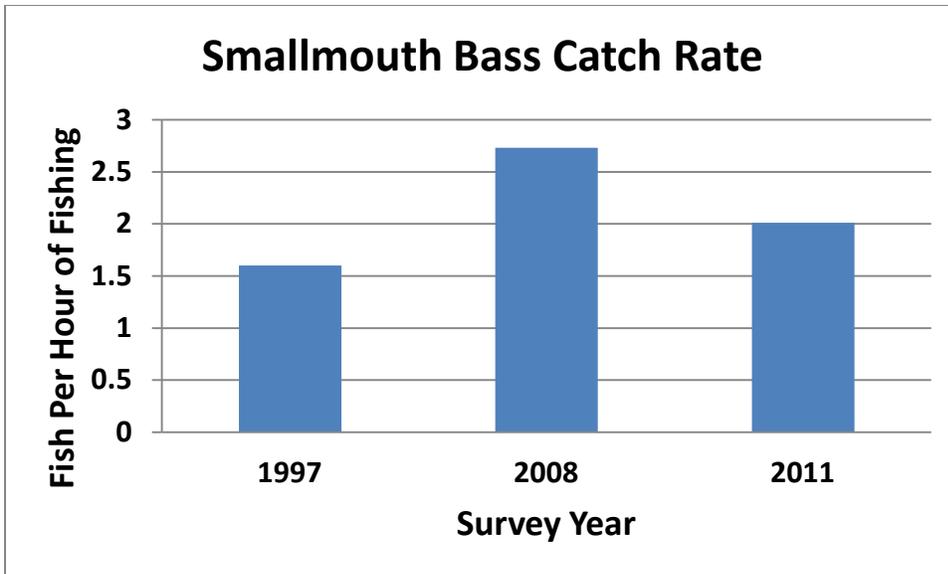


Figure 4. Smallmouth bass (angler) catch rate trend on the South Fork Shenandoah River.

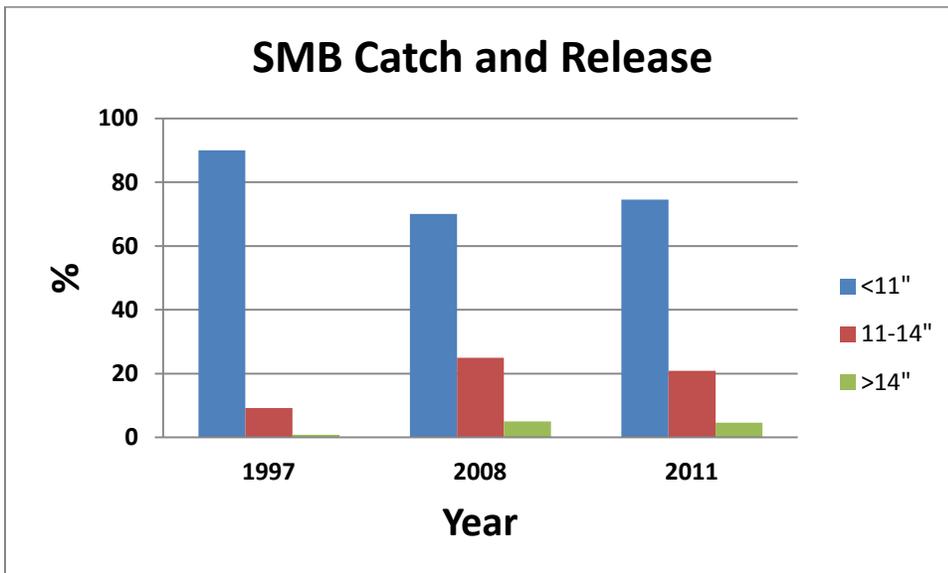


Figure 5. Size of smallmouth bass caught and released trend for South Fork Shenandoah River.

### South Fork Shenandoah River Smallmouth Bass Electrofishing Catch Rate

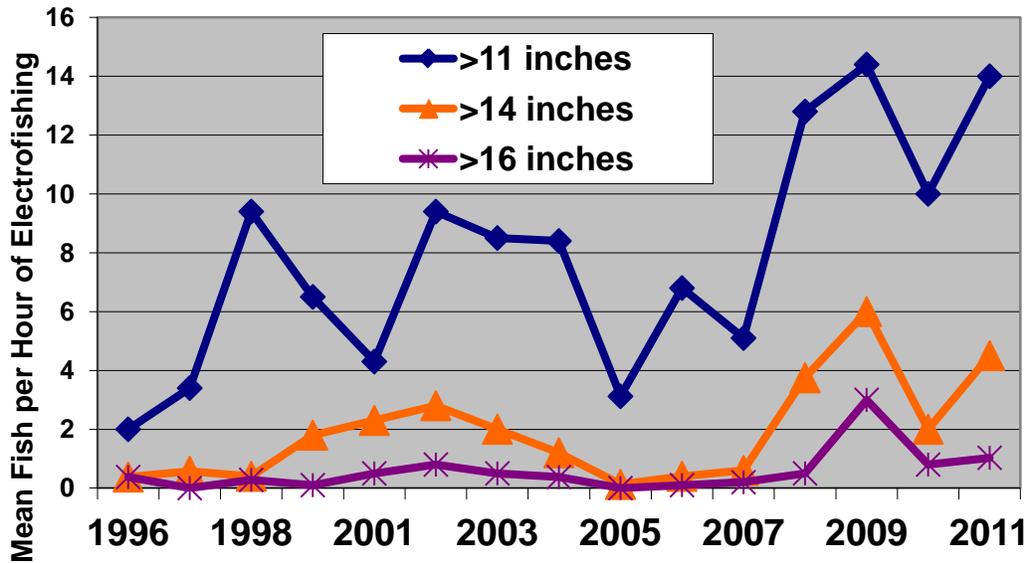


Figure 6. Electrofishing catch rate trend for different size groups of smallmouth bass, South Fork Shenandoah River.

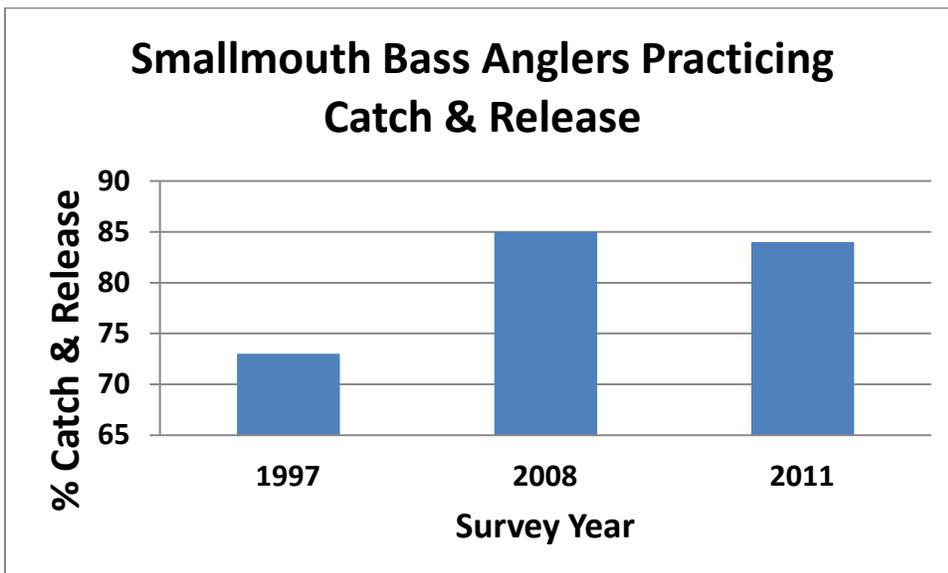


Figure 7. Trend in South Fork Shenandoah River smallmouth bass anglers practicing catch & release.

Appendix 1.

**2011 SF Shenandoah River Creel Survey Angler Questionnaire**

Date: \_\_\_\_\_ Interview #: \_\_\_\_\_ Time: \_\_\_\_\_ Reach: \_\_\_\_\_

- 1) How long have you been fishing today? \_\_\_\_\_ hours
- 2) How much longer do you plan on fishing? \_\_\_\_\_ hours
- 3) Fishing from: a) canoe b) powered boat c) kayak d) raft e) bank/wade
- 4) Fishing with a guide? Y N
- 5) How would you rate your angling experience today? 1 2 3 4 5 (circle one)  
Poor excellent
- 6) Did you or will you access the river from private land today? Y N
- 7) How has the average number of times you fish the SF Shenandoah River in a year changed in the past few years?  
\_\_\_\_ Increased \_\_\_\_ Decreased \_\_\_\_ Remained the same \_\_\_\_ First time ever fishing Shenandoah River
- Only ask question 8 if they answered "Decreased" for question number 7.*
- 8) If it has decreased, what is the **main** reason for this decline? (choose only one) **Only give them these choices if they cannot come up with any reasons of their own.**  
\_\_\_\_ not as much free time \_\_\_\_ Price of Gasoline \_\_\_\_ Fish kills/disease \_\_\_\_ Other reason
- Only ask question 9 if they answered "Fish Kills" in question number 8.*
- 9) How much has your fishing on the Shenandoah River declined due to the fish disease, from pre-kill years?  
\_\_\_\_10% \_\_\_\_20% \_\_\_\_30% \_\_\_\_40% \_\_\_\_50% \_\_\_\_60% \_\_\_\_70% \_\_\_\_80% \_\_\_\_90%
- 10) What fish species are you targeting today? a) smallmouth bass b) sunfish c) catfish d) musky  
(circle only one)

**\*\* Only ask questions 11-14 to anglers who said they were fishing for smallmouth bass**

- 11) Of the following scenarios, which would be the best fishing day for you?  
\_\_\_\_ I caught 50 smallmouth bass, the biggest one was 10 inches long?  
\_\_\_\_ I caught 30 smallmouth bass, the biggest one was 14 inches long? (Check only one)  
\_\_\_\_ I caught 15 smallmouth bass, the biggest one was 18 inches long?  
\_\_\_\_ I caught 5 smallmouth bass, the biggest one was 20 inches long?
- 12) Would you harvest a smallmouth bass  $\geq$  20 inches? Y N
- 13) What do you consider to be the minimum size of a quality smallmouth bass?  
a) 10" b) 12" c) 14" d) 16" e) 18" or > (circle one)
- 14) Would you harvest any legal-size smallmouth bass? Y N
- 15) Have you caught any muskie in the last 5 years, even if you were not fishing for muskie? Y N
- 16) Have you fished just for muskie on the Shenandoah River in the last 5 years? Y N  
*Yes: answer questions 17-18 No: Go to question 19*
- 17) Over the past 5 years has your muskie catch rate on the Shenandoah River:  
Increased Decreased Remained the Same Don't Know / Not Sure

