

# Cowpasture River Fish Community Assessment

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## Fish Community Assessment History

The Virginia Department of Game and Inland Fisheries (VDGIF) began to monitor the fish population in the Cowpasture River in the 1990's. Prior to that, the Department did not have the proper equipment to adequately assess the river's fish community. However, monitoring smaller streams in the Cowpasture River Watershed was conducted. The size and average depth of the river limits reaches that can be sampled with a small electrofishing boat. VDGIF has collected sportfish population data at several locations on the Cowpasture River over the previous twenty-three years. Sampling locations from upstream – down to the mouth: Wallace Tract, Riverside, Sycamore Bend, Windy Cove, Nimrod Hall, Walton Tract, Lynchburg Camps, and Griffith. However, sampling effort and consistency has varied over that time period. This lack of consistency (year, season, location) has made it difficult to accurately document changes in the sportfish community. The best way to document changes in the fish population is to minimize sampling variability by choosing permanent sampling locations and returning during the same season on an annual or semi-annual basis. VDGIF has added a electrofishing raft to our arsenal of sampling equipment. This new raft will allow us to sample more of the river giving us a better picture of the river's fish population.

## Fish Population Trend Analysis

VDGIF's boat electrofishing equipment is biased toward sampling larger fish, and it is also not very effective in surveying shallow (riffle) habitats where many fish species inhabit. VDGIF also targets sportfish during our surveys of the Cowpasture River. Therefore, we have more accurate information on species like smallmouth bass, rock bass, redbreast sunfish, white sucker, and musky than other small, non-game species like shiners, minnows, and darters. Fortunately, there have been two comprehensive fish community surveys completed on the Cowpasture River (Mohn et al. 1973 ; Olden 2004) that looked at the entire fish community. In the future VDGIF plans to incorporate additional sampling gears to monitor species and habitats currently being overlooked. This data should be comparable with the 1973 and 2004 surveys.

Species richness and diversity is commonly used as a measure of river health. The fish community in regard to species richness appears to be relatively unchanged over the past forty years (Figure 1). Mohn et al. (1973) collected 25 different fish species from main Cowpasture River sample locations. Olden (2004) observed 28 different fish species in the main Cowpasture River in his study. VDGIF collected 19 different species in 2009 and 24 in 2013. Species lists from over the years do not contain the same species. Since different sampling gears were used and habitats surveyed differed, it is unknown if the overall fish species assemblage has truly changed since 1973. A list of fish species collected by VDGIF in 2013 can be found in Table 1.

## Smallmouth Bass

VDGIF has never conducted an angler creel survey on the Cowpasture River. However, recent Department surveys on the James and Maury River indicated that anglers prefer smallmouth bass above all other species. This is probably also true for the Cowpasture River. VDGIF uses the number of fish collected per hour of electrofishing as a measure of abundance. It appears that relative abundance of smallmouth bass has increased in recent years (Figure 2.). Abundance of smallmouth bass rates in the middle of all the major smallmouth rivers in Virginia (Figure 3). The recent increase in abundance can be attributed to smallmouth bass spawning success in 2008 and 2009 (Figure 4). Recruitment of fish into the population is what maintains and increases overall bass numbers. VDGIF sees this in other Virginia rivers like the Shenandoah, New and James. The average catch rate of young-of-year smallmouth bass in the James and Shenandoah Rivers is 30 fish per hour of electrofishing. Anything >30 fish per hour is considered an excellent spawn and those fish will remain in the population for many years. Biologists can track an individual spawn or “year-class” because they have aged bass and understand the age/size relationship. Fluctuations in spawning success vary from year to year and are mainly driven by spring river flows (Figure 5). Smallmouth bass in the Cowpasture River are slow growing and long lived. It takes about 6-7 growing season for a smallmouth bass to reach 12 inches in length and they may live to the age of 12-15 (Figure 6). Most of the smallmouth bass that VDGIF collects are between the ages 0-5. Large (14”+) smallmouth bass are not that numerous in the Cowpasture River. Due to water chemistry, underlying geology, and the low productivity of the river this is not surprising. In 2013 only 2% of the bass sampled were >12” (Figure 7). The size distribution of smallmouth bass in the population is almost identical to that observed by VDGIF in 2009 (Figure 8). VDGIF has not monitored the population consistently over the past decade and there may not actually be any statistically significant change in bass abundance over time. Focusing on one sampling location (Griffith) we can see the variability of smallmouth bass abundance between years, but overall it appears that bass numbers have not changed significantly over time (Figure 9.). Smallmouth bass abundance by sample station over the past few years shows a increasing trend from 2007-09 and then a decline in 2013 (Figure 10). This could be driven by spawning success in previous years. However, we cannot know for sure since there were no electrofishing surveys conducted 2010-2012.

A disease and mortality event occurred in adult smallmouth bass during the spring of 2007 throughout the Cowpasture River. Similar, less intense disease/mortality events occurred in the smallmouth bass population in 2008-09. The cause of these disease/mortality events was determined to be a coldwater bacteria (*Aeromonas salmonicida*). Biologists use a metric called proportional stock density (PSD) to describe the proportion of quality size fish in the population. The majority of the smallmouth bass mortality 2007-2009 was seen in the older/larger smallmouth bass. VDGIF electrofishing data reveals a significant decline in PSD between 2005 and 2013, with the most dramatic decrease occurring after the 2007 fish kill event (Figure 11). However, VDGIF does not have enough historic smallmouth bass population data to know if this

decline in PSD is a consequence of the fish kills or natural variability. Regardless of the fish kill events, the Cowpasture River does not have a high percentage of larger smallmouth bass in the population as compared to other Virginia rivers (Figure 12). More consistent surveys of the smallmouth bass population will be necessary to identify the extent of natural fluctuations in smallmouth bass abundance and size structure before biologists can attribute population changes to abnormal events.

### Rock Bass / Redbreast Sunfish

The most abundant species throughout the Cowpasture River are rock bass and redbreast sunfish. Smallmouth bass are generally a close second in numbers to these other members of the sunfish family. Rock bass prefer cooler water temperatures than smallmouth bass and redbreast sunfish. Because river temperature increases from the headwaters downstream to the mouth, rock bass abundance declines moving downstream from the headwaters to the mouth of the river. Redbreast sunfish prefer warmer water temperatures than rock bass and their abundance tends to increase from the headwaters downstream to the mouth. Productivity and physical habitat also affect sunfish abundance so density of both species is lower in the extreme headwater reaches of the Cowpasture River. The disease/mortality events 2007-2009 were also observed in adult rock bass and redbreast sunfish throughout the Cowpasture River. A decline in redbreast sunfish abundance was observed after the most intense fish kill year. However, the redbreast population appears to have returned to “normal” levels (Figure 13). The trend in rock bass abundance is not as clear. Combining all survey locations, rock bass abundance appears to be increasing 2007-2013 (Figure 14), but the population appears to have remained relatively unchanged over the past twenty years while looking at one specific reach (Figure 15). Overall the Cowpasture contains the highest density of rock bass of all Virginia Rivers surveyed by VDGIF (Figure 16).

### Overall Fish Community Status (2013)

Fish populations in the Cowpasture River reflect those from other small to medium size, low productivity rivers. Species richness remains relatively unchanged over the past forty years. VDGIF uses boat electrofishing catch data to assess fish populations in the Cowpasture River. Water temperature, river flow, turbidity, time of year, physical habitat, and even changes in sampling gear can affect the catch rate of fish. There is also a high degree of natural variability in fish abundance (for all species) from year to year. Most of which is caused by spawning success. Spawning success is influenced by environmental conditions (mainly river flow). Most of the changes in fish abundance over the past twenty years could be considered within the range of what these populations experience naturally. There appears to be some evidence of a reduction in the abundance of larger smallmouth bass following the fish disease/mortality events 2007-09. However, the density of larger bass appears to be improving. Distribution and relative abundance of other sportfish species are within the expected range for a river with the

Cowpasture’s characteristics. More consistent monitoring will be necessary to determine if significant changes can be attributed to abnormal conditions or events. Overall, VDGIF finds the fish populations in the Cowpasture River to be in good condition.

**Table 1.** Fish species collected by VDGIF during fall electrofishing surveys 2013 (N=24).

smallmouth bass	northern hogsucker	chain pickerel
largemouth bass	white sucker	cutlips minnow
rock bass	creek chubsucker	common shiner
redbreast sunfish	brown bullhead	black jumprock
bluegill	yellow bullhead	marginated madtom
green sunfish	torrent sucker	rainbow trout
pumpkinseed sunfish	fallfish	brook trout
muskellunge	central stoneroller	mottled sculpin

**Figure 1.** Total number of fish species collected in during electrofishing surveys.

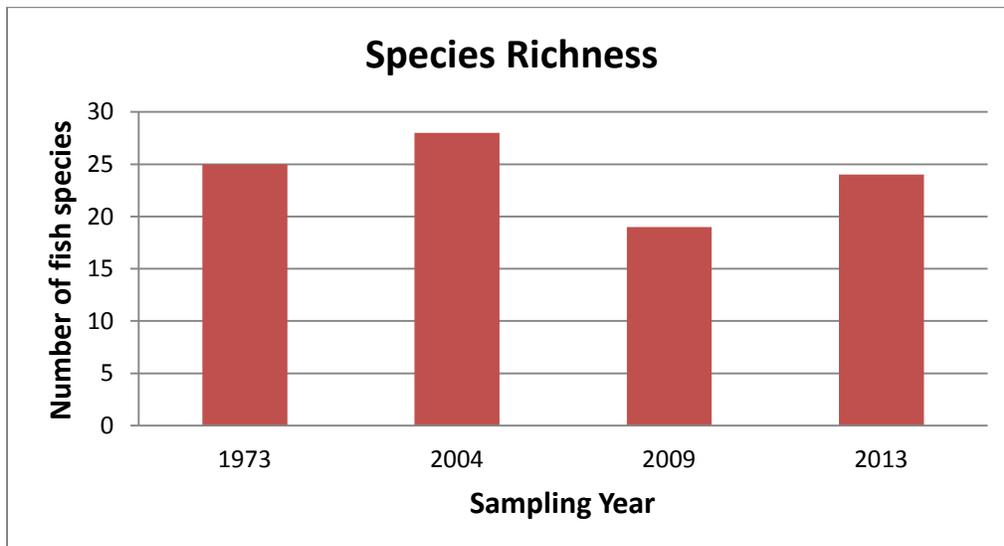


Figure 2. Mean number of smallmouth bass collected per hour of electrofishing.

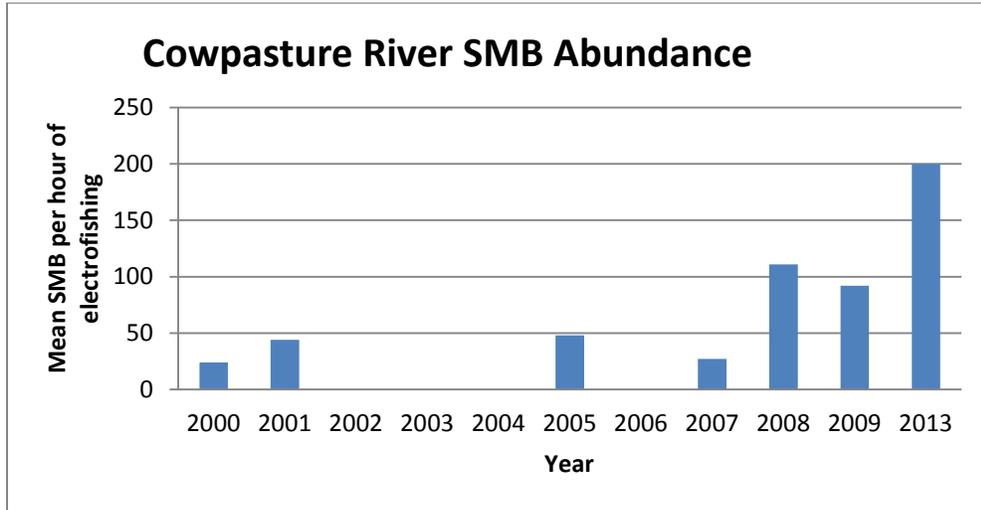
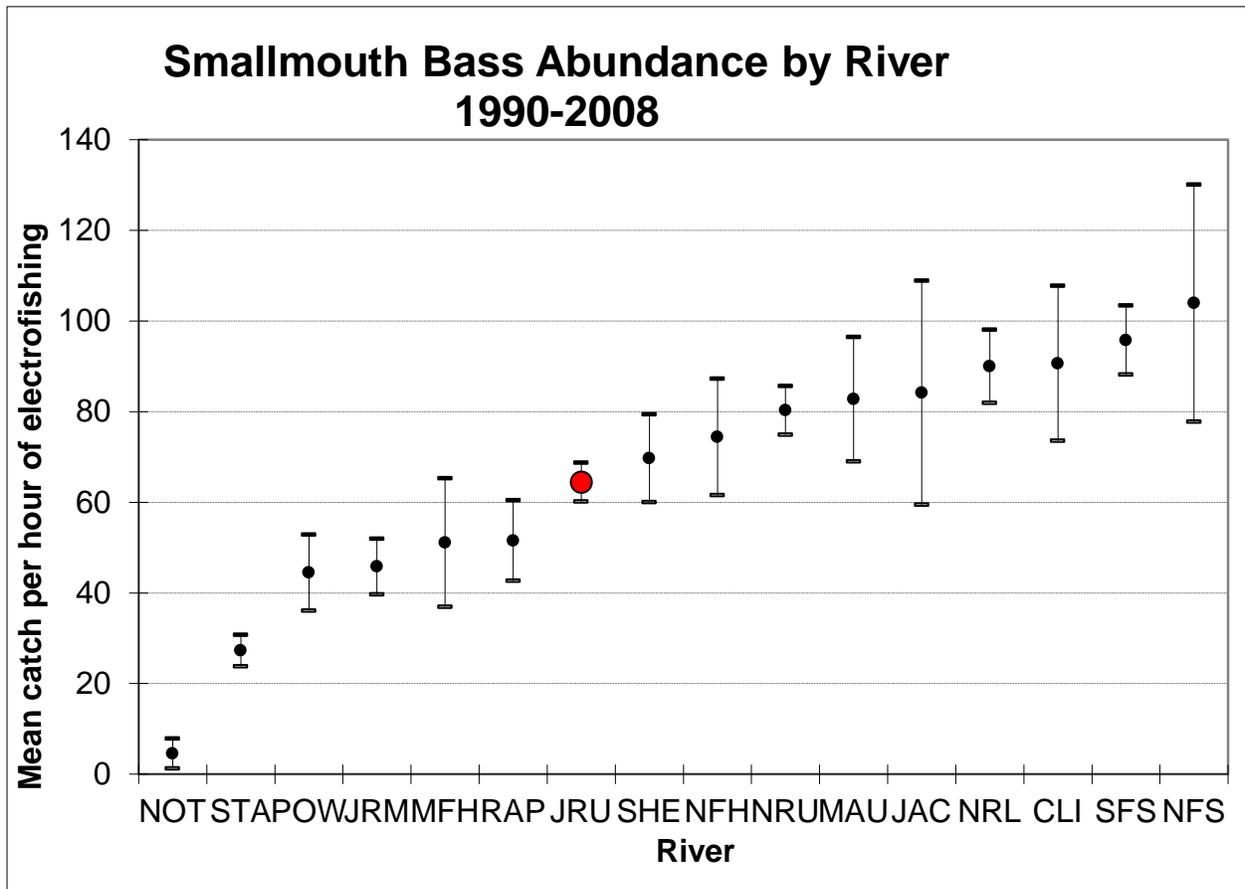


Figure 3. Smallmouth bass abundance for Virginia rivers 1990-2008.



NOT = Nottoway ; JRU = upper James ; MAU = Maury ; JAC = Jackson ; NFS = North Fork Shenandoah

Figure 4. Mean number of baby smallmouth bass collected per hour of electrofishing.

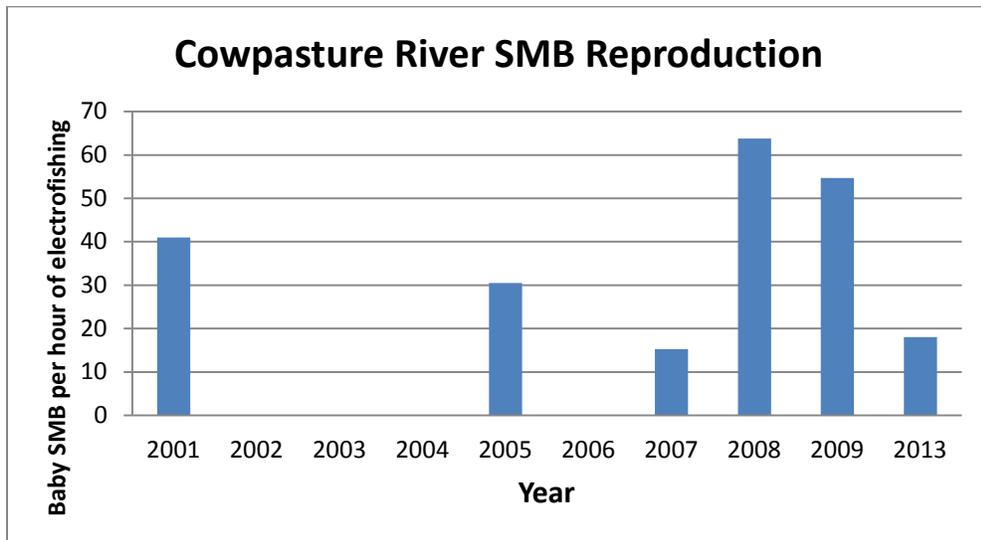


Figure 5. Smallmouth bass spawning success in upper James and Maury River.

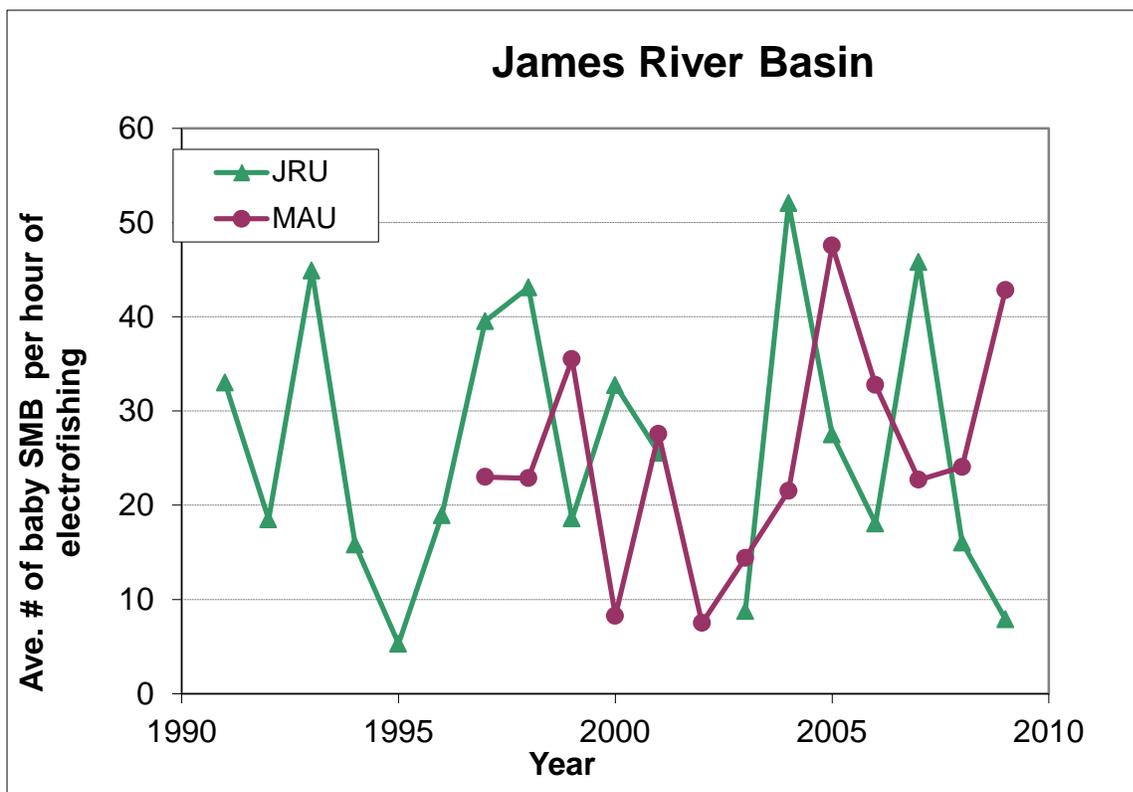


Figure 6. Age and growth of smallmouth bass.

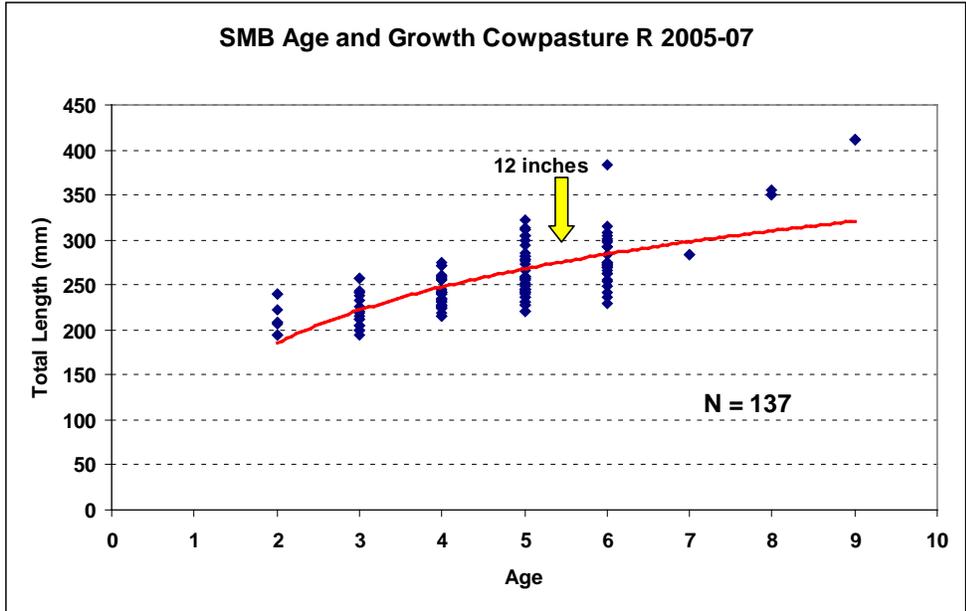
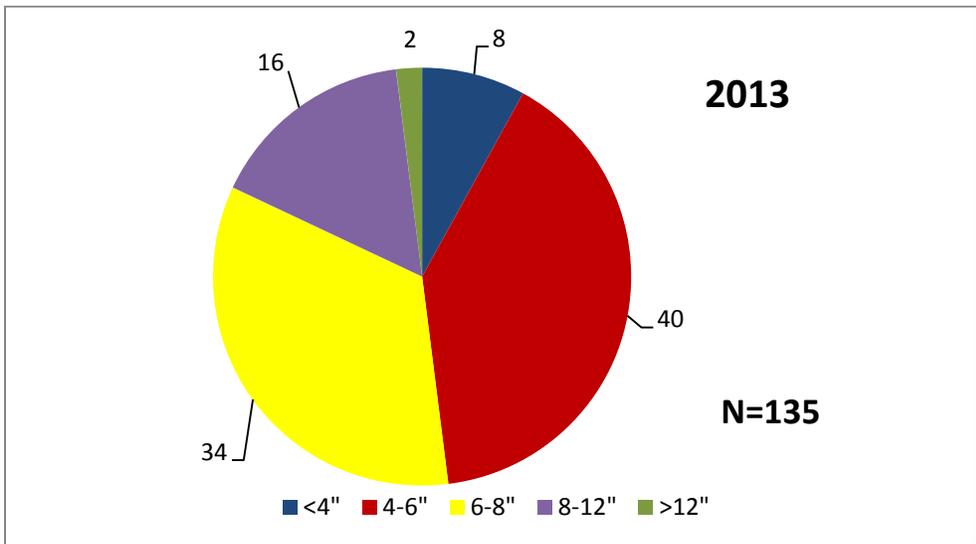
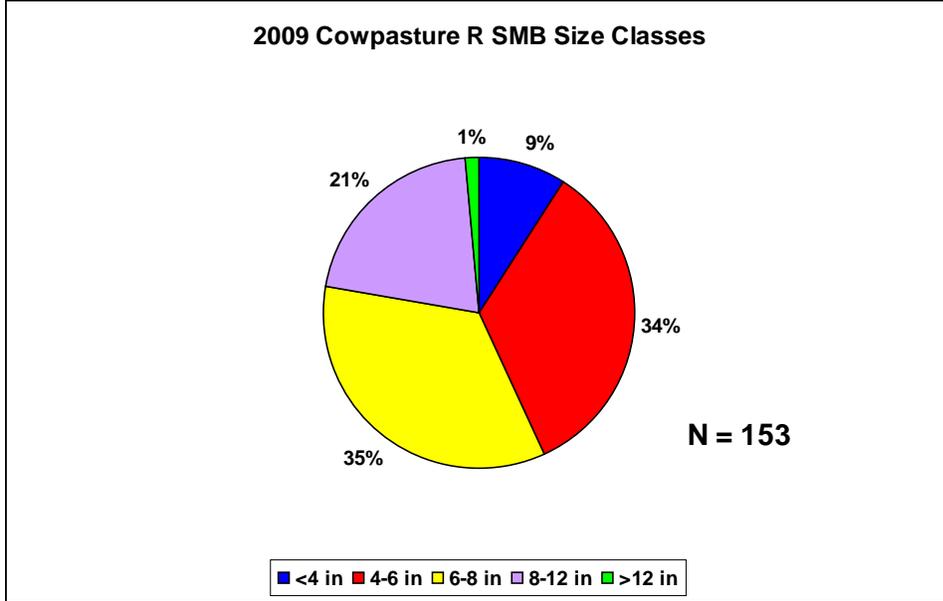


Figure 7. Percent distribution by size range of smallmouth bass collected by electrofishing (2013).



**Figure 8.** Percent distribution by size range of smallmouth bass collected by electrofishing (2009).



**Figure 9.** Number of smallmouth bass collected per hour of electrofishing (Griffith).

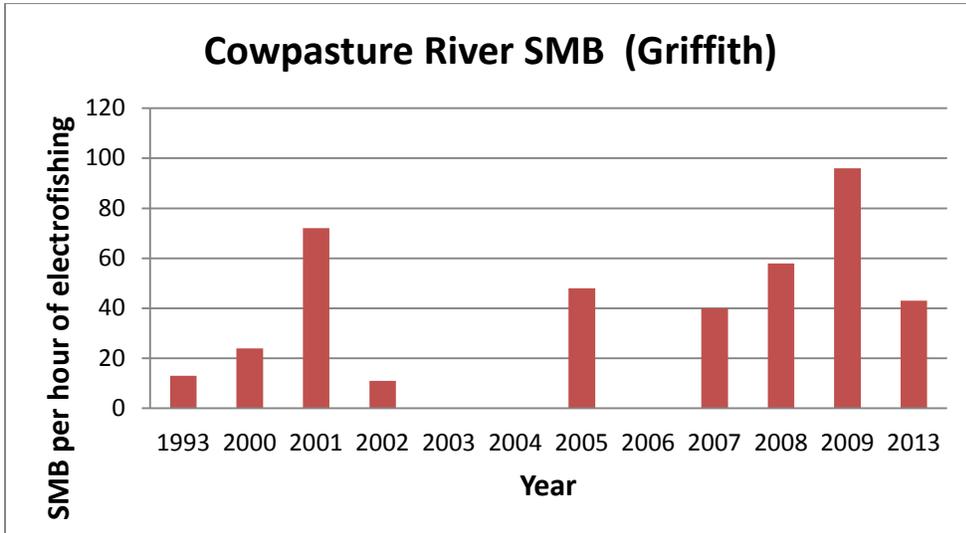


Figure 10. Number of smallmouth bass collected per hour of electrofishing (multiple sites).

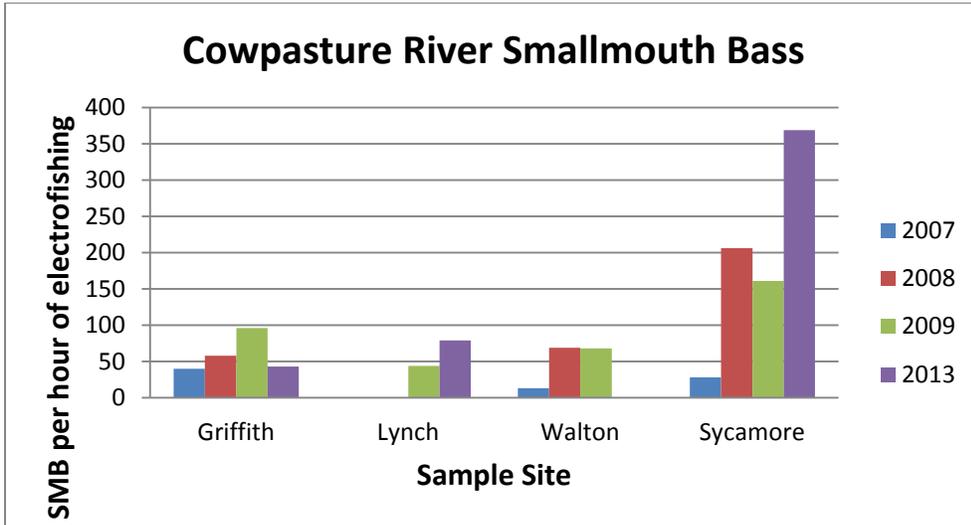
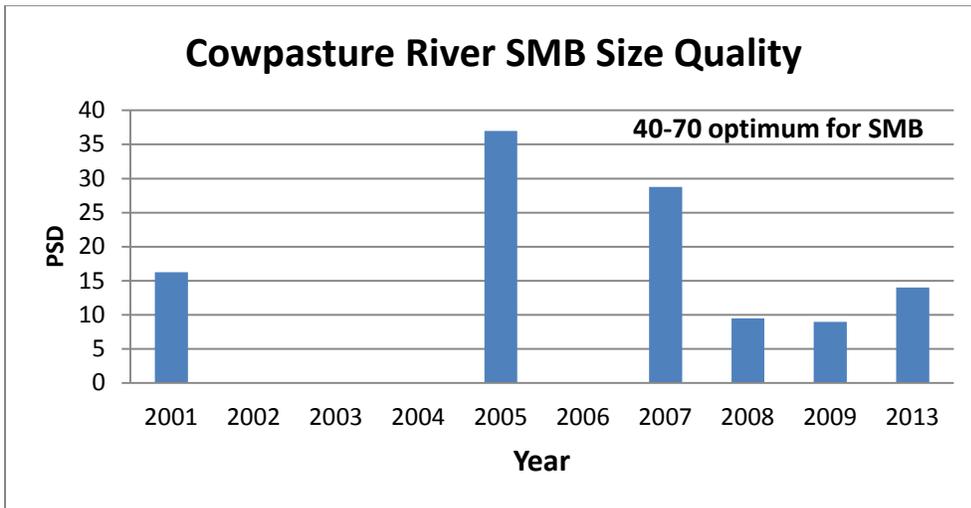
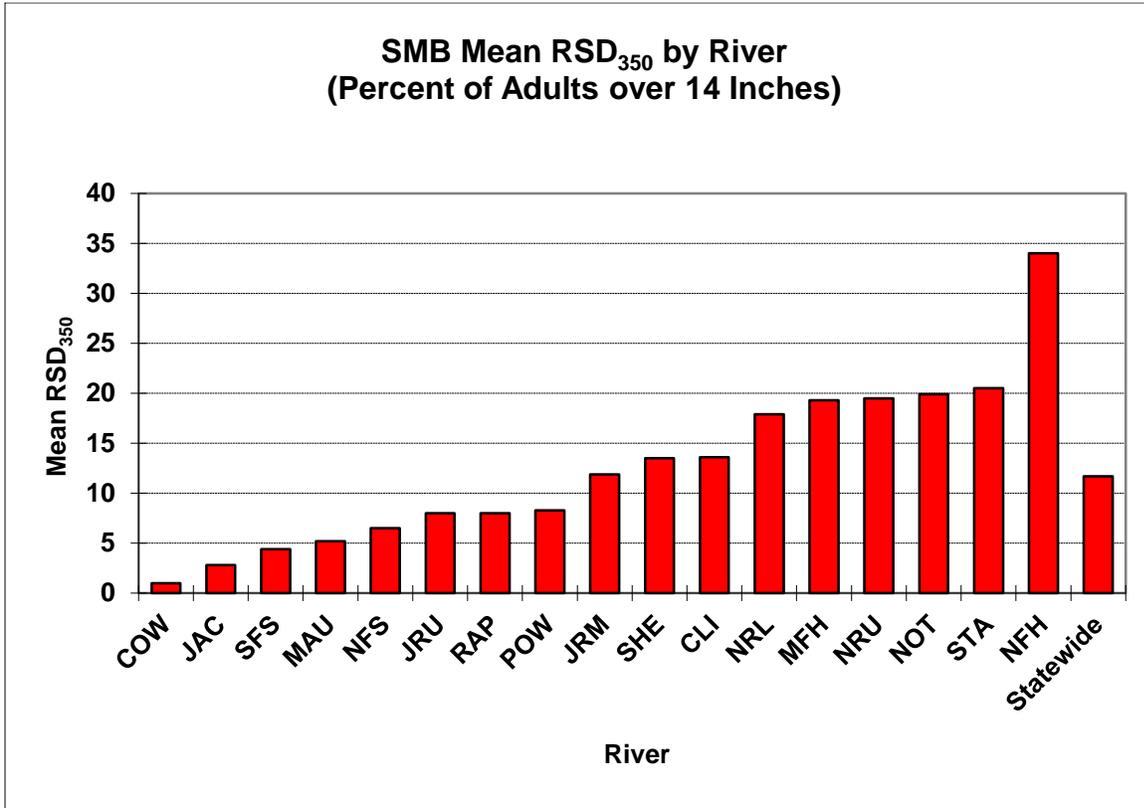


Figure 11. Measure of smallmouth bass size structure quality.



**Figure 12.** Percentage of smallmouth bass >14 inches in the population (Virginia rivers).



COW = Cowpasture ; JAC = Jackson ; SFS = South Fork Shenandoah ; JRU = James River Upper ; NFH = NF Holston

**Figure 13.** Number of redbreast sunfish captured per hour of electrofishing.

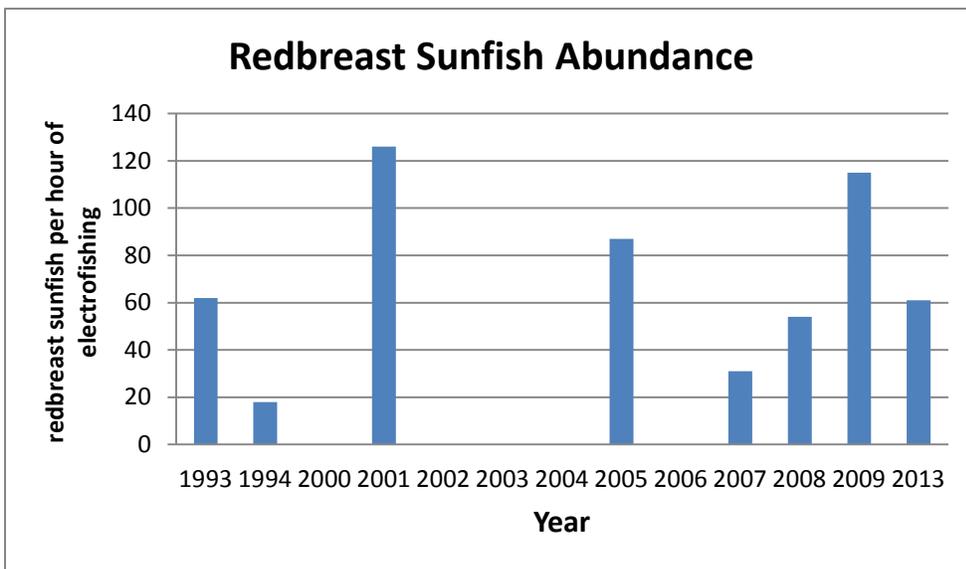


Figure 14. Number of rock bass captured per hour of electrofishing.

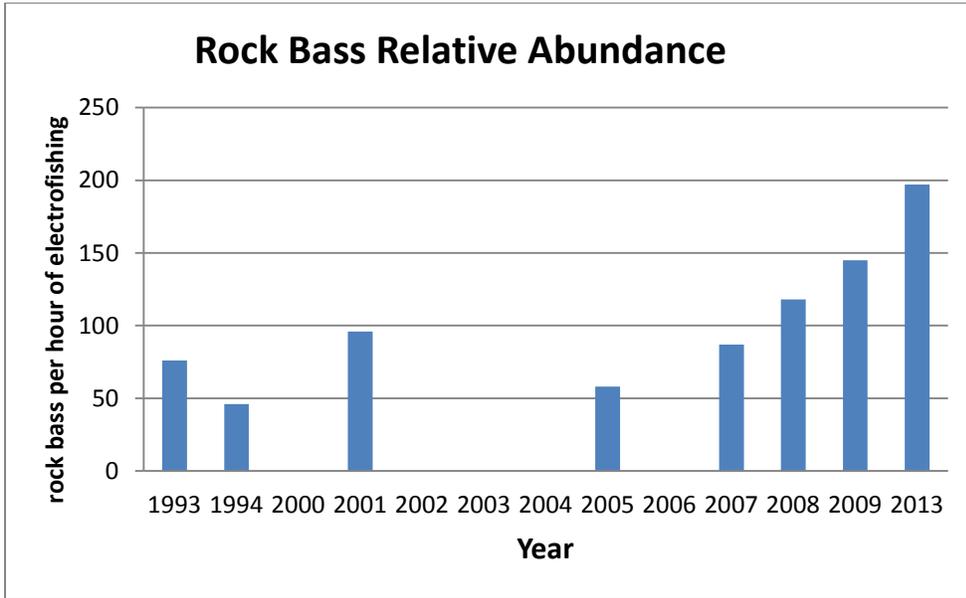


Figure 15. Number of rock bass captured per hour of electrofishing (Griffith).

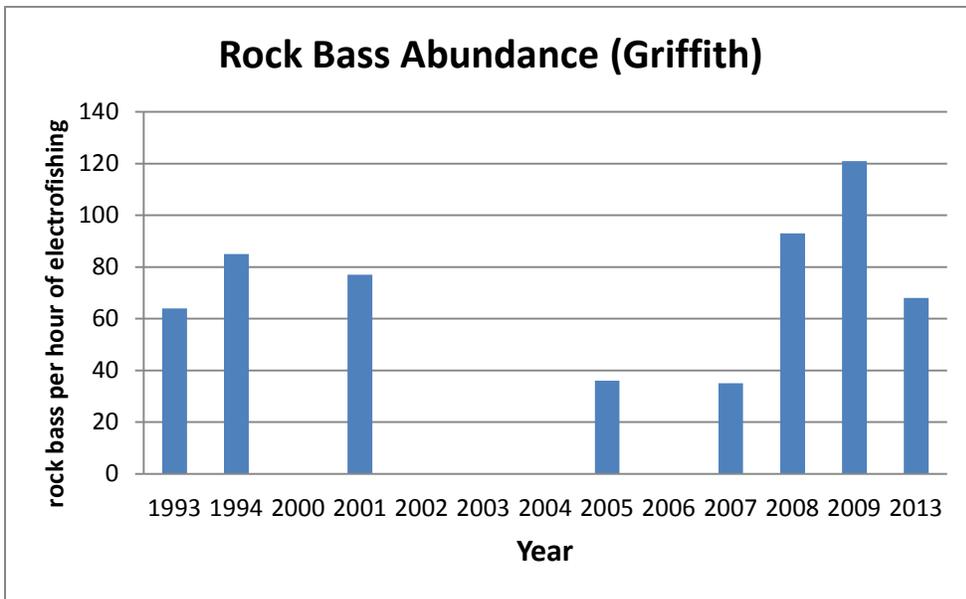
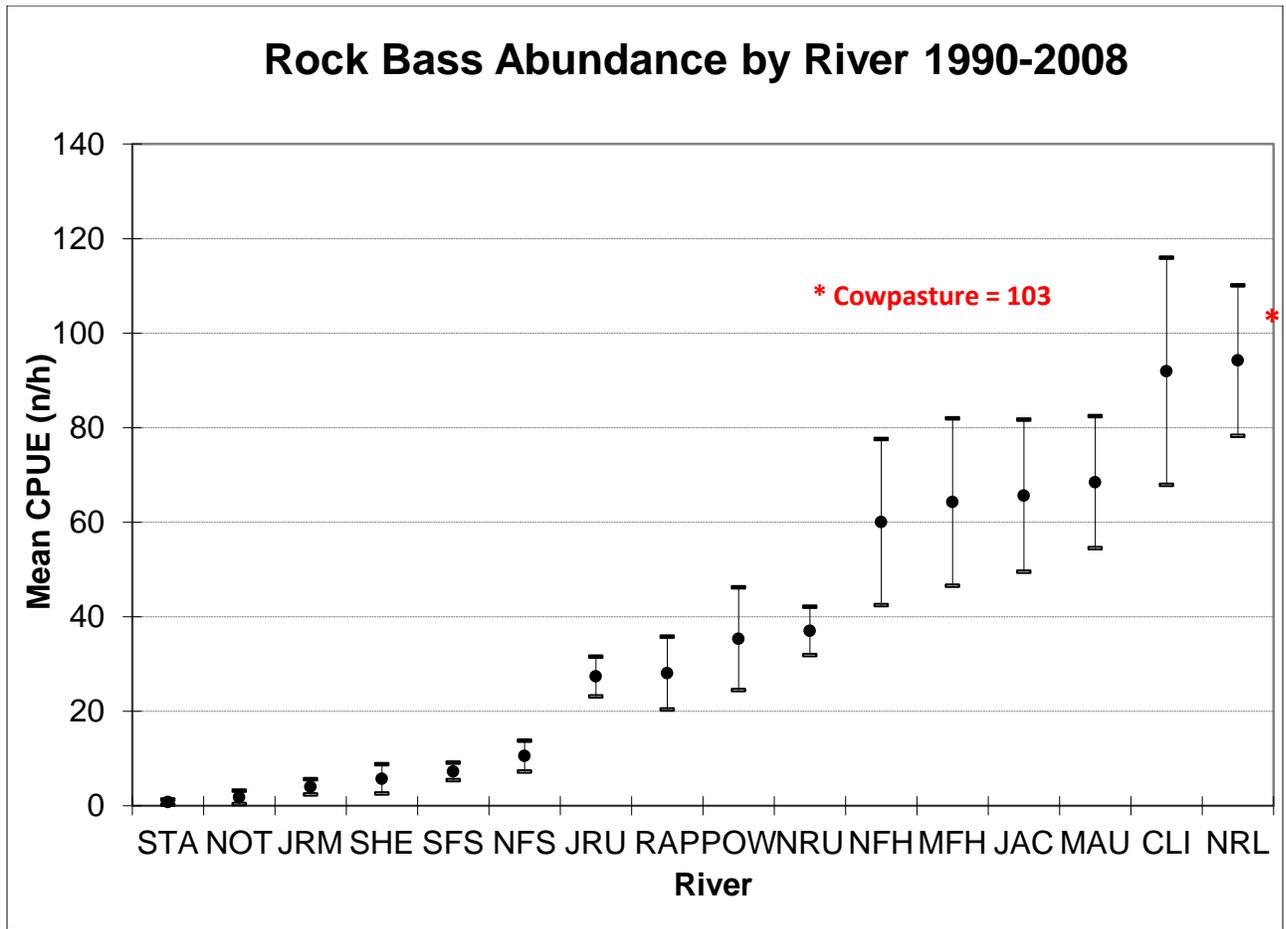


Figure 16. Rock bass abundance (catch per hour of electrofishing) in Virginia rivers.



Literature Cited

Mohn, L.O., Raleigh, R.F. and F.L. Carle. 1973. Biotic Survey of the Upper James River, Virginia. VPI&SU Special Report, 105 pp.

Olden, J.D. 2004. Biological Survey of the Cowpasture River, Virginia. Report Prepared for the Cowpasture River Preservation Association, 57 pp.