HISTORIC FISHERY OF THE BLACKWATER RIVER

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WILDERNESS

"Behold the land of Canaan" were a fur trader's first words in 1748 when viewing the high forested valley in the western part of Virginia (Robinson 1953). One can only imagine what the Blackwater River drainage was like then in its wilderness state. As a fishery biologist, who has spent most of my career studying and restoring West Virginia trout fisheries, I can imagine the ultimate river habitat for the only trout then present in the eastern portion of the North American Continent – the brook trout. In the valley the river was slow moving, dark and deep, with only a few riffle stretches in its 32 plus km (20 miles) of winding through the 21 km (13 mile) long valley where it then exited through a cut in the surrounding mountains. The banks were forested with immense eastern hemlock *(Tsuga canadensis)* and red spruce *(Picea rubra)*, interspersed with rhododendron *(Rhododendron maximum)* that hung over the river to gain the little sunlight able to penetrate the forest canopy (Clarkson 1964). Every few meters a spruce or hemlock lay submerged in varying degrees of decay, attesting to the thousands of years of the forest's existence, providing cover for the brook trout and increased habitat for the aquatic insects that they fed on. In the critical summer months the river maintained a good flow with water temperatures that probably did not much exceed 16ºC (61ºF) because of the shading of the river and the many centimeters (ft) of forest duff (humus) that held water, which was released during dry periods. While the color of the river was a dark cinnamon or black, hence its name, the water chemistry was excellent for the trout and the macroinvertebrate populations they relied upon for most of their food. The pH was probably 7 or above with calcium, phosphorus, and other nutrient concentrations ideal for maximizing the river's productivity (WVDNR 2000). During the spring and summer months species from 18 or more Genera of mayflies (WVDNR 2000) would leave the river's bottom and, those that escaped the brook trout's stomach, took flight for their annual courtship. The limestone geology of the valley floor (Fortney 1975) provided the basis for the subsequent river chemistry. If you or I were able to go back and fish the Blackwater during this period we would catch many 305 mm (12-inch) to 330 mm (13-inch) brook trout with a few fish in the 380 mm (15-inch) range (Kennedy 1853, Menendez et al. 1996). The fish would be deep bodied showing the excellent food and trout habitat the river provided. If we were good trout anglers, we would easily catch 100 or more fish a day unless a late spring snowstorm forced us to find cover (Kennedy 1853, Selders 1917). If we were to fish using dry flies, it would require chest waders to traverse the river because of the steep 1-1.4 m (3-5 ft) high banks and the dense forest. We would also have to share the fishing with the river otter *(Lutra canadensis)* (Robinson 1953) and an occasional osprey *(Pandion haliaetus)* or bald eagle *(Haliaeetus leucocephalus)*. The fishery in the river would have been almost exclusively brook trout (Kennedy 1853, Selders 1917, Menendez 1996). Other species such as the redside dace *(Clinostomus elongatus)*, a glacial relic, were certainly in the Blackwater's drainage (Stauffer et al.1995). Larger trout soon ate any dace, or other open water species that ventured into the main river. These species probably thrived in the smaller tributaries not often frequented by 305 mm (12-inch) and above brook trout. Other species that spent most of their life hugging the river substrate were probably able to withstand the predation of the trout and reproduce there. These could have included the johnny darter *(Etheostoma nigrum)*, the greenside darter *(Etheostoma blennioides)*, and the mottled sculpin *(Cottus bairdi)* (Stauffer et al.1995, WVDNR 2000).

Leaving the valley through the gap between what were to be named Canaan and Brown Mountains, we would fish a river that was gaining speed as the stream gradient increased. The river was a little wider than, not as deep with frequent riffles, its banks not as steep, with more rock and cobble in its substrate. Looking into the shallower riffles we would be able to see large numbers of fingernail clams *(Sphaerium spp.),* snails *(Heliosoma anceps and Physa heterostropha),* and lesser numbers of the squaw foot mussel *(Strophitus undulatus)* (Schwartz and Meredith 1962, WVDNR 2000). Lifting up a rock or two we would be able to catch a crayfish *(Cambarus bartonii carinirostris)* and use the tail to bait our hook (Jezerinac et al.1995). The river was still enclosed on both sides with the dense forest, but we could probably work our way along its banks. It was also beginning a gradual turn to the southwest after flowing through the valley in a general northeasterly direction. About 5 km (3 miles) down river we would reach a major tributary entering from the north. This would be the site where the town of Davis would be built and the tributary named Beaver Creek. We would also be fishing a section of the river where others fished when the area was still a wilderness and, more importantly, left a record for us (Kennedy 1853, Selders 1917). Until now we have imagined a fishery based on 20th Century surveys and research, tidbits of information from other publications, and on my own best judgments. The earliest record of fishing the Blackwater River was that of Philip Pendleton Kennedy (Kennedy 1853). Kennedy made his trip into the area in 1851, and while the descriptions of the forest, streams, and fishing are very interesting reading, they are limited to wilderness conditions. Additionally, Kennedy and his party fished the North Fork of the Blackwater River mistaking it for the main river (Brown 1959, Zurbuch 1996). In contrast are the writings of Valentine Selders who in 1917, wrote the history of his life as a farmer in Preston County (Selders 1917). Selders included one chapter in his "A Pioneer's Memoir", titled "Trip to Blackwater for brook trout", where he detailed a number of fishing excursions to the Blackwater River. These started about 1865, 14 years after Kennedy's trip, and continued into the early 1900s. Valentine describes fishing in the wilderness, witnessed the settlement of the area, the increased fishing after the railroad reached the river, the effects of logging on fishing, and eventually the destruction of the brook trout fishery.

Kennedy used a number of pseudonyms for himself and others on their 1851 trip to the Blackwater. The one I think best fits him for this trip, and his later life, was "Murad the Unlucky". After being lost for nearly a day and a half, he finally reaches a stream his guides tell him is the Blackwater River, he fishes the stream which is the North Fork of the Blackwater, and then writes a book describing the fishing, and the "Great Falls" of the Blackwater. Descending to the mouth of the North Fork he sees what he believes is the Cheat River, but in reality is the Blackwater River of his quest. However, his description of the brook trout fishing is the first recorded for the area, very enlightening, and warrants having an excerpt here. Having descended below the highest falls on the North Fork, and fishing in the pool below it, he described the fishing: *"The master (Kennedy) drew up the first fish. He had thrown in just at the edge of the foam and spray of the fall, and a quick, bold pull swept his line through the foam. On the instant, with a switch of his rod sidewise, then throwing it up aloft, he landed between his thighs (for it was water all around him) a fine vigorous trout, breaking off about two feet of the switch-end of his maple rod. This trout was a foot long, and some three inches deep behind the shoulders. …It was great work, and the excitement intense. In the course of a quarter of an hour we had caught, among all of us, some twenty fine fish – some of them thirteen inches long – and this with no other bait than the common red worm. Indeed, if to take a quantity of trout be your only objective, so full is the stream of them, and so ravenous are they, that with any sort of a line, and anything of a hook – a pin-hook if you can get no other - you may take as many as you can carry."* Kennedy also comments on a color variation of the brook trout

caught: *"This rock we have appropriated as our kitchen; and upon it we have counted out some five hundred trout, varying in size from six to ten inches – some of them, the black trout, with deep red spots – and some salmon-colored, with lighter red spots – all of them very beautiful…"*. Sweet (2002) in the Preface to a recently released edition of the "*The Blackwater Chronicle"*, postulates that Kennedy may have recorded a unique strain of brook trout that was later destroyed "*…as a result of subsequent environmental degradation"*. Maybe so, but I believe it may have been simply the difference between male and female fish. In hatchery fish, especially with rainbow trout, some of the males will be almost black, while the females will be much lighter having the typical coloration for the species. When Kennedy writes about salmon-colored trout is he referring to the "color" or the "salmon"? The salmon he would have probably been familiar with was the Atlantic salmon *(Salmo salar).* Or, it may have been the color difference between freshly caught fish and those that had been caught hours previously. Maxwell (1884), however, when describing the color of the Black Fork (Blackwater?) as being a dark red further states: *"Even the fish…are colored by the water. Not only does the color attach to their scales, surface and fins, but their flesh, if properly so called, is colored throughout"*.

Much like the trip Kennedy made, Selders and his friends first rode horses from home in Preston County as far as practical, and then hiked the remaining distance to the Blackwater River. In later years, they would take horse and wagon part way, and then ride the railroad to their destination. Having been on a hunting trip to the area previously, he did not get lost on his first trip for brook trout as Kennedy had. This is what he said about this (circa 1865) trip: *"I will here tell of a trip Bro. Christian, Jacob Beachy, and I made to Black Waters when it was a vast wilderness. I had been up there once before on a hunting trip, so I did not need a guide this time. We traveled on horseback as far as the old George Mosser place, then sent our horse's home and traveled 10 miles through the wilderness on foot. That evening we reached the place where the town of Davis now is, after which we went to fishing and caught 40 nice trout for supper. We cut down a large pine tree and peeled the bark off, which we used to build us a camp for the night. We decided to fish down the stream to Black Water Falls the following day, and up the stream the next day, which was to be our last day, as we had arranged to meet a man with our horses the following day, to take us home. Well the second morning we started out fishing down the river and continued on till evening but were not in sight of the Falls yet. The fish were biting so well that we did not get along very fast. Bro. and I got into the stream and waded down. I remember Jacob Beachy was fishing along the bank, and he said every time he looked at us, one, or both of us were taking a fish off our hooks. The second morning we decided we wanted to see the Falls, so we fished down stream again, and went pretty fast. We reached the Falls at noon, which is a grand site, the water falling over a precipice 62 feet. We ate our lunch, and fished a while at the Falls, but did not catch as many fish as we did farther up the river; we fished up the stream toward camp again. In the evening about quitting time I was fishing at the mouth of a little stream and emptied into the river, where I could catch them as fast as I could take them off of my hook and bait it again. The boys went on and told me to come, that night would overtake us, after which I said I would come just as soon as the fish would let up a little, but it was the same old thing. I saw the boys still going on, so I pulled out another one, and broke the line from my pole, and started on. We cleaned our fish and salted some in buckets which we took home. On that journey we had good weather, a fine time, and caught over 600 fish."*

SETTLEMENT

The West Virginia Central & Pittsburgh railroad reached the site of the town of Davis in the fall of 1884 at the same time the clearing of the land was completed so the town could start to be

constructed (Guthrie 1998). Up to that time only a few families lived in the area, but that soon changed as the Timber Barons of the late 1800's moved in to claim their share of the red spruce, eastern hemlock, balsam fir *(Abies balsamea),* black cherry *(Prunus serotina),* and other hardwoods (Clarkson 1964, Michael 2002). By 1909 most of the timber had been taken from Canaan Valley and the loggers had moved into the area southwest of Davis that included the Blackwater Canyon. By 1925 the lumber mills had closed, or moved elsewhere, and the whole of Tucker County was reduced to stumps (Robinson 1953). The question arises, how long did the brook trout fishery withstand this onslaught? Again, we can turn to Valentine Selders (1917) as he recounts another fishing trip to the Blackwater. *"Some years later, after the railroad was built up to Davis, we tried our luck again on the old Blackwater. Bro. Christian, who was then living near Accident, in Garrett Co. Md. came up with several young men. There were 8 of us this time, and we walked over to the railroad, which was a distance of about 8 or 10 miles, then boarded the train for Davis, which we reached soon after the middle of the day. We wanted to get some distance away from town so we walked up the river 3 miles, and camped under a large rock which extended out over the bank. It began raining again, and we were ready to fish about 3 o'clock that afternoon, and fished till 6 P.M., when I had 126 trout, which I pulled out in 3 hours, that being the most I ever caught with the hook in that length of time. The second day we fished until 11 o'clock then got ready to go home. Eight of us had caught more than 800 fish, and Bro. and I had caught more than half of them, as we were racing. The first day I beat Bro. and the next morning he beat me, but both days fishing put together I had more than Bro. had. That was some fishing, sure."* Valentine ended his chapter on fishing the Blackwater River with these sad comments. *"I was up there several times since that, but did not do so well, as they were being caught out more rapid after the railroad came to Davis. People came in from other states to catch brook trout, which were the only fish in there then, but now the trout are all gone, and there are a few suckers and chubs to take their place. When that country was all wilderness there was some of the finest timber there that I ever saw, but it is all gone now"*. From these writings it is evident that excellent brook trout fishing continued after the logging commenced. How long this continued is up to conjecture, but for a while the fishery may have even improved as additional woody vegetation was put into the river and summer flows increased as transpiration loss was reduced from the dwindling forest. Nutrient concentrations may have also increased for a while during and after the logging as was shown in the Fernow Experimental Forest located near Parsons (Eschner and Larmoyeux 1963). The brook trout is a rugged fish able to withstand a lot of adversity following impacts to its habitat. In West Virginia we often find the only species left in acid deposition impacted streams is the brook trout (Clayton et al.1998). One physical condition they cannot overcome, however, is high water temperature. Some of my colleagues have asked what caused the destruction of the Blackwater River's brook trout fishery. Was it the additional tannic acid in the river from logs being floated to the mills, or the increased sedimentation from the logging? While I believe tannic acid probably was not a problem and sedimentation had an impact, the increase of the river's summer water temperatures was the deciding factor that made the river unsuitable habitat for them (Needham 1938). This is supported by Valentine Selders comments "*… but now the trout are all gone, and there are a few suckers and chubs to take their place"*. Fish were still able to survive in the river, but not the brook trout. This is the condition we see in a number of our streams, which in wilderness condition were brook trout fisheries, but after logging became too warm and the brook trout survived only in the higher elevation tributaries. It was also true in the case of the Blackwater River. Many of its headwater tributaries maintained a brook trout population long after the logging was finished and some still do today (Allman 1976, WVDNR 2001). The critical river temperatures were probably reached soon after the logging as the result of

the fires that removed the many feet of forest duff, which previously acting as a sponge, released cool water in the summer (Brooks 1965). When the logging railroads were extended into Canaan Valley and onto its surrounding mountains there was great care taken to prevent fire from the locomotives (Guthrie 1998). A fire did burn on Canaan Mountain from May to July 1894, but the woods crews were able to keep in away from most of the railroad. In 1900, however, another fire that swept over the mountain consumed the wooden supports the rails were laid upon (Guthrie 1998). Fanser (1962) in his "History of Tucker County" describes two major fires, one in 1910 near Davis that burned 7,000 acres, and another in the Blackwater canyon that burned for 6 months from May to November 1914. Michael (2002) in his recently released book "A Valley Called Canaan: 1885-2002", describes a major fire occurring in 1923, but this was fictitious fire designed to fit the book's story and a consolidation of a number of fires that he believed burned in the early 1920s (E. D. Michael, West Virginia University, personal communication). Some fires were deliberately set as it was the policy of Henry Gassaway Davis and Stephen Benton Elkins, local timber and coal barons of the era, to burn timbered lands to try and convert them into a vast grazing range (Fanser 1962). Species such as the creek chub *(Semotilus atromaculatus),* bluntnose minnow *(Pimephales notatus),* white sucker *(Catastomus commersoni),* and stoneroller *(Campostoma anomalum)* repopulated the former brook trout habitat (WVDNR 2000). In Shavers Fork, the southern tributary of the Cheat River, we have a record of the fishing that shows this change. Logging in the Shavers Fork drainage started in earnest about 1900, some15 years after Canaan Valley, when a railroad was built into its upper reaches from Cass (Clarkson 1964). A sportsman club's log lodge, now referred to as the Cheat Mountain Club, had been built on this section of the river. The club maintained a fishing record from 1894 through 1922. Here are some of the entries: *"1894, July, 115 trout (brook trout), one day trip; 1900, June, 129 trout, four days, water too cold for big trout up stream, only caught one 11 ¼", all fair size but not as big fish as on former trips, water so cold almost impossible to wade; 1901, June, largest trout of the season – 13 ¾"; 1901, July, 1 trout 12 ½", 4 trout 11-11 ¾", 10 trout over 9 ½"; 1903, August, had a royal good time and caught bbls. of fish; 1904, June, 1 trout 10", 1 trout 13 ¾", 1 trout 14", one hour catch -raining; 1905, June, 11 trout, trout jumping – caught 11 between hours of six and nine p.m., several rods were in use but no expert anglers were present; 1910, May, 26 trout, got trout in forenoon, one 11 ¼", one 10 ½"; 1911, June, 67 trout, 1-12", 3-10", several 9"; 1912, May, 50 trout and 2 chubs; 1914, July, chubs, only few trout – many (Oh thousands) of chubs (Ye little fish), it is this writers opinion that this date is too late for trout; 1917, June, chubs, 1 barrel of chubs; 1917, September, we want more fish in the stream."* If such a log had been maintained at the "Dobbin House", a summer retreat built in 1859 near Blackwater Falls on a promontory overlooking Pendleton Run (Fanser 1962), and the house and log still existed, we would find the decline in the brook trout fishery and ascendancy of a chub fishery recorded in similar fashion, but 10 years or so earlier than that of Shavers Fork.

RECOVERY

Following the logging and fires the Blackwater and its tributaries began to recover, although the recovery can only be accurately called a partial recovery. Never again would the water quality match that found by Kennedy (1853) and his friends. The fabled brook trout fishery would be only written about, not experienced. The valley would be partially reforested with fire cherry *(Prunus pennsylvanica)* and the trembling and bigtooth aspens *(Populus tremuloides and P. grandidentata)* that emerged among the rocks exposed by the fires (Brooks 1965, Michael 2002). Large sections would be used for grazing cattle and growing hay (Allman 1976). The National Forests were put in place and the Civilian Conservation Corps formed to try and reclaim the land ravaged by the logging

and fire (Brooks 1965). Some of the western slopes of the valley were included in the National Forest system, but most of the Blackwater River drainage would remain in private ownership. West Virginia was involved in trying to save the fisheries in the state as early as 1877 when the West Virginia Fish Commission was organized (Kinney 1963). In their first year the Commission issued a report that shows their concern: *"…the best of our streams scarcely afford sport for the anglers and no one relies on them for a supply of food."* In this first year they also constructed a fish hatchery and stocked over 700,000 trout, salmon, shad and bass. The Fish Commission was no match for the timber and coal interests in the state, and by 1883 trout stocking was discontinued. During this period there is no hatchery record that any trout were stocked in the Blackwater River drainage (Zurbuch 2002). Since the fishery was still excellent until well after the railroad was built into Davis in 1884, there was probably no clamor from disgruntled fishermen to stock trout as there must have been in other areas of West Virginia. There may have been an unrecorded stocking, however, of rainbow trout *(Oncorhynchus mykiss)*, called "California trout" during the early trout-stocking period, in the lower reaches of the Blackwater River. Robinson (1953) relates this conversation with his uncle: *"Uncle Thad Hinebaugh only the other day when speaking of old Judge Dobbin recalled when Clarence Livengood and Mr. Overholt, the founder of Overholt Whiskey, visited Dobbin Manor. At daybreak they went down below the Falls where they caught huge rainbow trout while at the same time a painter (panther) was screaming at them from its crest."* Fanser (1962) gives the construction dates of the Dobbin House (Manor) as 1858-59 and its destruction by fire as 1884, which would fall in the time period of the State's first venture into rearing trout. Valentine Selders also stayed at the Dobbin House when, during a spring fishing trip he and his companions were forced to take shelter there, the house being unoccupied at the time, after being caught in a late spring snow storm (Selders 1917).

West Virginia did not get back into the fish hatchery business until 1930, but the federal government did, and opened the White Sulphur Springs hatchery in 1902. During the next 30 years, most of the trout stocked in the state came from the White Sulphur Hatchery. The first recorded trout stocking in the Blackwater River was in 1909 near Davis, and consisted of 25,000 rainbow trout fingerlings. These rainbows were listed in the hatchery stocking records as "California trout". I believe one can correctly assume that the Blackwater River brook trout fishery was in serious trouble by the time the 1909 stocking was made. In the early fish stockings it was hoped the fish would grow into adults, spawn, and repopulate the streams. This did not happen in the trout stockings except in isolated instances where water quality and habitat conditions matched the requirements of the species. The opposite occurred with some of the warm water species as is shown by the "huge success" of the 1879 introduction of 7 common carp *(Cyprinus carpio)* into West Virginia waters. In 1910 the first recorded brook trout stocking was made in the Blackwater River. Again the trout were stocked in the vicinity of Davis and included 2,500 fingerlings. Brown trout *(Salmo trutta)* were first introduced into West Virginia in the 1891-92 period when 10,000 fingerlings were stocked in streams of the state. There was no record of which streams were stocked. Some may have been placed in the Blackwater River drainage; however, the 1891-92 Annual Report of the West Virginia Fish Commissioners does not mention the Blackwater River or any of its tributaries as receiving any stocking. These first stockings of brown trout were recorded as "Loch Leven trout"; referring to their Scottish origin. A few browns were introduced into the state from Germany (von Behr trout). In later years, when West Virginia hatcheries began rearing brown trout, they were referred to as the Loch Leven strain. In 1925 the State's annual report shows 30,000 brook trout fingerlings being stocked in the Blackwater River and its tributaries. In that same year the Federal Hatchery report listed 58,100 "Loch Leven" brown trout stocked in West Virginia waters. Some of these may have

been placed in the Blackwater, but again, the locations of the stockings were not recorded. The first recorded stocking of brown trout in the Blackwater River was in the 1933-34 period when 4,050 fingerlings were planted in the main Blackwater with no specific location given. It was also reported that during the same period there were 4,200 brook trout fingerlings stocked in tributaries of the Blackwater. By 1940 the stocking of fingerling trout was being replaced by stocking of adult fish, of all 3 species (brook, brown, and rainbow), and leading to the present-day "put-and-take" fishery. Fingerling trout are still being stocked, but comprise a rather small outlay in the overall State hatchery budget. Currently, the Blackwater River is annually receiving 20,000 plus adult trout and 100 to 200 pounds of fingerlings mostly consisting of brown trout (Zurbuch 2002). The stocked sections of the Blackwater River are described in the "West Virginia Trout Fishing Guide" (WVDNR 1996). During this "recovery" period for the Blackwater River, which I will place as 1909 to 1940, there is scant information that I can find, on the rate of the recovery and the fate of the trout stockings. Since by the mid-1920s fingerling stockings were pretty much on an annual basis, one has to assume water quality parameters were stabilized, and there was some optimism that the stockings, especially the brown and rainbow, would be able to survive.

In general terms, as I have mentioned, fingerling stocking of the various trout species did not return the streams to their former productivity, nor could it meet the fishing pressure exerted on them. But, in some cases conditions were such that the fingerlings survived, reproduced, and then maintained a population. This is easily observed in the case of the rainbow and brown trout, both having been introduced into the state. A good example of a self-sustaining rainbow population is Seneca Creek that heads near Spruce Knob and flows into the North Fork of the South Branch of the Potomac River at Seneca Rocks. There are also a few state streams that maintain a viable brown trout population. The success of the brook trout fingerling stockings is not so easily discerned. If we observe a stream with a self sustaining brook trout population, are the fish genetically the same as those present before stocking was initiated, are they the result of stocking, or a combination of the native trout and hatchery introductions? There have been a number of genetic studies to try and determine this. In West Virginia we observed a stream spawned brook trout population in a stream restored from the effects of acid deposition that indicated the population was a genetic mixture of hatchery and native fish (Menendez et al. 1996). I believe if a genetic investigation were made of the brook trout that still maintain themselves in some of the tributaries of the Blackwater River, we would find a combination of the various strains of stocked fish with those native to the drainage. Did the rainbow introductions into the Blackwater ever successfully spawn? There are no state fish collections that would indicate this, but Don Good, proprietor of the Canaan Valley Stores, said that when he fished the Blackwater in the central portion of the valley in the 1980-95 period, he would occasionally catch a rainbow that was distinctive from the hatchery stocked rainbow (D. R. Good, Canaan Valley Stores, personal communication). The rainbow would be more silvery with a brilliant red stripe down its sides. Mr. Good had heard that at one time rainbow trout successfully spawned in Club Run or Big Run. I have caught similarly colored rainbow when fishing the headwaters of Shavers Fork. These fish were probably from a documented spawning population of rainbow trout that maintain themselves in the upper reaches of that river. Some State Fishery Biologists feel that brown trout have spawned successfully in a number of the tributaries of the Blackwater River in Canaan Valley. I personally have observed brown trout spawning in the North Branch and Freeland Run (1960s), but do not know that they were successful or not. With all of the hatchery stockings of brown trout fingerlings over the years in the river, one could not say that brown trout caught by anglers, or collected during fish surveys, were of hatchery origin or stream spawned. In 1999, however, a chemical (rotenone) sampling of a section of the Blackwater River

within the canyon, turned up some fingerling browns that originated from stream spawning of the resident brown trout population (WVDNR 2000). The survey was well before any stocking of brown trout fingerlings were made that year.

My interview with Don Good revealed some other interesting Blackwater River fishing information covering the 1940-95 period. Mr. Good was raised in Davis and his father fished the Blackwater River below the Falls for brown trout in the 1940s. He told of catching large browns using night crawlers as bait. As a youth, Don had fished the headwaters of Beaver Creek for brook trout and the Blackwater River in the valley catching rainbow, brown and brook trout. He had never, however, fished in the canyon where his father had fished. Finally, in the early 1990's, he, and a friend named Sandy Green, decided to replicate his father's canyon fishing. They collected a good supply of night crawlers and made a early morning decent of Pendleton Run to the Blackwater River where they commenced fishing upstream toward Blackwater Falls. It took them a good 10 hours to reach the falls! They had fished their night crawlers for about half the distance to the falls and had not caught or seen a fish and were about to give up. Sandy Green decided then to switch baits and tied on a spinner with a yellow fly – Don could remember the exact lure. On his first cast, using the spinner and fly, Sandy caught a nice 406 mm (16-inch) brown trout. Both men began fishing spinners and catching. In the remainder of their fishing trip they caught 6 brown trout, 1 rainbow trout, 1 brook trout, and 1 largemouth bass *(Micropterus salmoides).* When the brook trout was netted a brown trout followed it into the net and was captured also. No chubs or other fish species were caught or seen. The brown trout were much darker than those the men had caught in Canaan Valley and had large red spots on them. They were in good condition, although not fat, indicating their food supply may have been limited. Mr. Good believed the other 3 species had been swept over the Falls and originated from hatchery stockings. The brook trout was very slender which may have been the result of temperature stress and poor feeding. Largemouth bass had been stocked in Canaan Valley beaver *(Castor Canadensis)* ponds in 1963 and 1964 by the State and this specimen probably traveled down river from one of those ponds (WVDNR 1964). A couple of years after this fishing trip (1994) the State conducted a fish survey below the Falls and collected one brown trout and a number of non-game species (WVDNR 2000). For 15 years (1980-95) Mr. Good and 11 other anglers would spend a week in mid-April camping alongside the Blackwater River in Canaan Valley. Included in this party was John Copper whom I also interviewed (J. W. Cooper, Attorney at Law, Parsons, personal communication). The group would put canoes in at the Jason Harmon Bridge (Timberline Bridge) located in the middle part of the valley, and float down river where they would set up camp. At the end of the trip they would canoe down to Camp 70, where the river leaves the valley, and meet their transportation to take them home. They would fish up and down river from their camp and soon got to know the habitat in the river where they could catch trout. The trout they caught were mostly from hatchery stockings that had drifted down from up stream or worked their way up from below Camp 70, since no hatchery truck could reach that part of the river. Occasionally, they would catch a brown or a rainbow with pink flesh showing it was a holdover from some previous years stocking or may have been spawned in one of the Blackwater's tributaries. The largest trout Mr. Good can remember catching on these excursions was a 508 mm (20-inch) brown trout. He could not remember catching any brown trout less than 203 mm (8 inches). They tried fishing at night for large browns but only caught "catfish" that were probably brown bullheads *(Ameiurus nebulosus)* (WVDNR 2000, 2001). Mr. Good believes brook and brown trout reproduced successfully in Sand Run before the lake was constructed on it. A few years after the lake was filled he received permission to fish it in the early 1980s. For a few years he was able to catch and release brown trout from 356-610 mm (14-24 inches), along with citation size brook trout. Most of the trout

were caught in the upper part of the lake in the old stream channel where some springs were located. He believes that brown and brook trout are still reproducing in Sand Run above the impoundment. After the lake was opened to general fishing the big trout disappeared. He also fished the North Branch of the Blackwater and caught all 3 species of trout with the browns running from 203-457 mm (8-18 inches), although he saw larger ones. His uncle had told him that at one time there was good native brook trout fishing in the headwaters of the North Branch. Don also mentioned a spring at the lower end of the North Branch that trout would gather in during summer months. John Cooper also reported catching big brown trout in the North Branch. Mr. Cooper presently resides in Canaan Valley, and Yoakum Run flows through his property. He says Yoakum Run, Glade Run, Idleman Run, and Freeland Run all still contain native brook trout populations. I also interviewed Mr. Harry Reed who fished the Blackwater River frequently from 1958 to 1985 for big brown trout (H. Reed, Canaan Heights, personal communication). Most of his fishing in the Blackwater River was from Camp 70 up to the mouth of Sand Run. Although he does not fish as much these days as he use to, he did catch a 457 mm (18-inch) brown last year (2001) and believes he could do the same today. He had good success using live grasshoppers for the large browns. In the summer, Mr. Reed observed big brown trout moving into Sand Run to the section where springs were located. He observed brown trout spawning while trapping in beaver ponds on the North Branch. He also observed trout staying in the springs behind "Cooper's" house. Allman (1976) tells of a number of springs on farms in Canaan Valley that held big brown and brook trout that were fed and treated as pets. She also says that most of the tributaries from the western slopes of the valley contained native brook trout until State Route 32 was constructed, then the muddy water from the construction eliminated most of them.

I guess I would be "remiss" if I did not relate some of my early fishing experiences on the Blackwater River. I fished it once in the late 1940s just above Davis. My uncle had a camp on Sliphill Mill Run located between Parsons and St. George. One day we journeyed from the camp up to the Blackwater for a day of trout fishing. I can't remember much about the trip except that I wanted to go back for more fishing. I got that chance in the early 1950s while attending West Virginia University. I would borrow the family "Olds 88" and make a number of trips to the Blackwater. I fished the section of the river between Davis and Camp 70. The most exciting part of the trip would be driving the car across the bridge over Beaver Creek. The bridge had no planking at that time except narrow parallel sets of boards that just fit the width of the car tires. I would drive the car upriver and then hike up away and fish downstream toward the car. I fished wet flies that I tied myself, and usually fished 3 at a time. I usually caught a good number of rainbow and brown trout that were probably mostly hatchery fish. Occasionally, I would hook a large brown trout while fishing this section of the river. In 1957 I moved to Elkins as an employee of the West Virginia Conservation Commission (WVDNR) and fished the Blackwater often in the late 1950s and early 1960s. I fished mostly in the upper and mid-portions of the river in Canaan Valley. I had switched to dry fly fishing by that time and had good success, again catching mostly hatchery rainbow and brown trout with the occasional large brown. One trip sticks in my mine because of the size of the fish and the means I used to catch it. I was fishing down river from the Jason Harmon Bridge and observed a trout feeding in an especially deep hole against the far bank. I tried a number of dry flies, even down to a number 18-size hook, trying to match the small flying ants the trout was feeding on. Finally, I took my penknife and scraped the material off the hook until only bare hook remained. I put the tip of my fly rod under a floating ant and let it crawl on it. Then with the ant firmly impaled on the hook, I made a perfect cast that placed the ant in a drift that took it directly over where the trout was feeding. The fish succumbed to the deception and I landed one of the largest rainbow I

had ever caught. The fish was better than 457 mm (18 inches) in length and in excellent condition. Perhaps its origin was a State or Federal Hatchery, but I could not see any evidence that it had once been in a hatchery runway. These "fish stories" show that the Blackwater River did recover after the logging and destructive fires, although the fishery was changed to a mostly hatchery supported one relying on two imported species, the rainbow trout from the west coast and the European brown trout. The brook trout was still present in some tributaries of the river, but could not exist in the main river.

Valentine Selders complained about the increased fishing pressure the Blackwater River received after the railroad reached Davis. After the river had recovered so that hatchery stocking of trout again provided fishing, this pressure from resident and nonresident anglers continued to increase. Five major West Virginia trout streams were censused during the 1959 season (Zurbuch 1962). These included stocked sections of the Blackwater River, North Fork of the South Branch of the Potomac River, South Branch of the Potomac River, Elk River, and Shavers Fork of the Cheat River. The Blackwater River had better than twice the fishing pressure than the other streams. It also had the highest return of the stocked trout (estimated 88%). This study helped in providing some basic information on fishing pressure and success of the trout-stocking program. It led to the present year-round open trout fishing.

ACIDIFICATION

The lower portion of the Blackwater River has been subjected to acid mine pollution from both deep mining and surface mining. A number of reports have been published on the history and extent of mining activities in the watershed (WVDNR 1982, 1981; U.S. Environmental Protection Agency 1971; Phares 1971). One of the earliest stream pollution surveys of the Cheat River and its tributaries was performed by Lewis V.Carpenter, Professor of Sanitary Engineering, West Virginia University, and L. Kermit Herdon, Chemical Engineer, West Virginia State Water Commission (Carpenter and Herdon 1929). The survey was undertaken after a fish kill occurred in Lake Lynn located on lower Cheat River in June 1929. The investigators believed the fish kill occurred following low flow by a concentration of mine acid that was moved down the river during a sharp rise in flow. They reported that most of the acid entering the upper Cheat River was from the Backwater River drainage, and specifically from its North Fork. They further observed there were no fish in the Blackwater River below the entry of the North Fork. The report is interesting reading and many of its conclusions are applicable today. Deep mining started near Thomas shortly after the railroad penetrated the region (Clarkson 1964). Coal was needed to efficiently fire the locomotives that ran on the main tracks and those that hauled the timber out of the woods. In later years additional mines were opened in the North Fork's drainage to provide the coal for the coke ovens that sprang up on the banks of the stream. Acid mine drainage from these mines and from surface mining that followed effectively eliminated the fisheries of the North Fork below Thomas and the main Blackwater below the junction with the North Fork. There is no report that I can find on what the fishery was like in the Blackwater Canyon before the logging and mining began. Kennedy (1853) saw the river when he descended the North Fork to its mouth, but didn't recognize it as the Blackwater. It took his close friend David Hunter Strother, who accompanied Kennedy on the 1851 trip, 2 more trips into the wilderness before he actually viewed Blackwater Falls (Strother 1873). Strother, who wrote using the pseudonym "Porte Crayon", made the last trip in 1857 or 1858, but delayed writing about it until after the Civil War. On the trip he and some companions worked their way up to the Falls from the mouth of the Blackwater. The negotiation of the canyon was so arduous they had little time for fishing, or if they did they did not report it.

In the 1940s surface mining was started in the Beaver Creek, North Fork and Pendleton Run watersheds that added additional mine acid to the River. The mine acid pretty much eliminated the brook trout in these streams and undoubtedly reduced the productivity of the Blackwater River below the entry of Beaver Creek. In the late 1950s a strip mining operation on Beaver Creek broke into an abandoned deep mine releasing a large amount of concentrated acid water. This caused an extensive fish kill that continued from Beaver Creek down into the Blackwater canyon. The State removed the section of the Blackwater River from Beaver Creek to the Falls from the trout-stocking list in 1959 because of the pollution (Zurbuch 1996). In the mid-1960s a surface mining company attempted to treat the acid water in Beaver Creek by constructing a water powered rotary drum system that ground limestone into a slurry that was then introduced into the stream (Zurbuch 1984). The rotary limestone drum system had been developed by the State's Game and Fish Division to treat lightly buffered acid water in Otter Creek a tributary of the Dry Fork River (Zurbuch 1963). Because of the limited amount of water to power the drums the system neutralized only about 20% of the stream's acid load. The dam, constructed to provide water elevation (head) to turn the drums, was breached by a flood a few years after the treatment station was built and never repaired. The remains of the installation and some rusted drums can still be seen just upstream of the State Route 73 bridge crossing of Beaver Creek.

In the early 1990's West Virginia embarked on a stream restoration program to correct coal mine caused acidity (Zurbuch et al.1997). The first river to be addressed was the Blackwater River (WVDNR 2000, Zurbuch 1996). The rotary limestone drum system had been substantially improved by the WVDNR in its efficiency to treat acidified streams and was successfully in use treating the acid deposition affecting Cranberry River (Zurbuch et al. 1996, Zurbuch 1993). Because the WVDNR had considerable experience treating acidified streams, they were given the task of designing a rotary limestone drum treatment station for the Blackwater River and assessing the effects of treatment on water chemistry and stream biology. The station was constructed on the main river about a half-mile above the mouth of Beaver Creek and went into operation in September 1994. It has provided continuous treatment since, and has restored the biological resources of the river down to the junction of the still highly acidic North Branch (WVDNR 2000). The fish population has increased in mass and species composition and an outstanding trout fishery is again present in the Blackwater Canyon. Brown trout and rainbow trout are both living in the canyon waters and brown trout reproduction was documented in a 1999 fish survey. From our experience in restoration of other acid trout streams, it takes about 10 years for the fish and macroinvertebrates to stabilize after initiation of neutralization (Clayton 1996, Menendez 1996). The 1999 Canyon fish survey (5^{th} year of treatment) showed a dramatic increase in the fish population from pretreatment levels. The number of fish increased from 598 to 7,890/ha (242 to 3,193/acre) and the mass from 10.2 to 47.4 kg/ha (9.1 to 42.3 lbs/acre). The sport fishery is expected to be mostly brown trout when it stabilizes. The section of river from the State Park bridge, just upstream of Blackwater Falls, down to the junction with the North Fork, has been made a "catch-and-release" fishery. I haven't fished the canyon, but both John Cooper and Darell Hensley told me that it is an excellent fishery (D. Hensley, Tory Mountain Outfitters, Davis, personal communication). Darell has guided a number of anglers into the canyon each year since its restoration. He usually goes down Pendleton Run to the Blackwater and fishes down river to the junction with the North Fork. He says the best fishing is in the spring or fall when water temperatures are ideal for trout. The problem is to catch a safe river flow and good water temperature at the same time. He has recorded some radical daily changes in water temperature in the canyon during summer months which he believes stresses the trout. He also believes they should be catching more brown trout, although a nice 406 mm (16-inch) brown was

hooked on one of his recent visits. He has also made some trips into the section of the river below the North Fork and has not been able to catch any trout.

The correction of the acidity still entering the Blackwater River from its North Fork has yet to be resolved. A part of the study of the effectiveness of treating the Blackwater to neutralize the acid entering it was to recommend a similar treatment for the North Fork (WVDNR 2000). The final recommendation was monthly treatment of the stream using in stream placement of limestone sand. The limestone sand treatment was estimated to be less than half the cost of treatment with a rotary drum system. The use of limestone sand to treat acid water was an outgrowth of the development of a more efficient rotary drum system (Zurbuch 1989). During the testing of the new system on Otter Creek, there were periods the test facility was inoperative because of high stream flow. After one exceptionally high flood, the downstream water chemistry showed undissolved limestone sand from the rotary drum was still effectively treating the stream's acid. A project was then initiated to try and use quarry produced limestone sand size particles to treat acid deposition affected streams. This research was highly successful (Clayton et al.1998) and over 50 West Virginia trout streams acidified by acid deposition are annually being treated with in stream placement of limestone sand. Further research showed the limestone sand could also be effective in neutralizing streams acidified by acid mine drainage (Menendez et al. 2000) and the Middle Fork River of the Tygart River was restored using the treatment method (WVDNR 2001, Zurbuch et al.1997). Much of this research was concurrent with the Blackwater River study and was the basis for the recommended limestone sand treatment of the North Fork. The West Virginia Division of Environmental Protection treated the North Fork with limestone sand for 1 year (2001). They also treated Beaver Creek with the limestone sand the same year. Because of funding problems treatment has been suspended, but it is planned to be started again in the near future (D. Broschart, West Virginia Division of Environmental Protection, personal communication). The surface mine and deep mine reclamation efforts of the West Virginia Division of Environmental Protection should be mentioned here. Besides greatly improving the ascetic qualities of the landscape, their efforts have substantially reduced the annual acid loading of the Blackwater River. Statistical analyses of long term water quality showed significant reductions in acid loading in both the North Fork and Beaver Creek when comparing data prior to 1994 to data after 1994 (WVDNR 2000). This amounted to a mean reduction of 2.21 metric ton/day (2.44 tons/day) (40%) from the North Fork and 1.02 metric tons/day (1.13 tons/day) (41%) from Beaver Creek. A similar reduction was probably realized in Pendleton Run. These were substantial reductions and made the in stream treatment of the remaining acid much easier.

The effect of acid deposition on the area's streams should be discussed here. McGavock and Davis (1935) conducted a stream survey for the U. S. Bureau of Fisheries in the Monongahela National Forest in 1934. One section of their report was titled "Acid Streams of Tucker and Randolph County". These included 2 tributaries of the Blackwater River: Devils Run and Lindy Run; and 3 tributaries of the Dry Fork River: Red Creek, Red Run, and Otter Creek. These streams were reported to have become so acid since 1930 that few or no fish were found in them. The pH was reported to be < 5.2, which was the lower limit of the equipment they had with them. They believed with reforestation and increased rainfall, the survey was during a drought period, that in time these streams would probably regain their original condition. This did not occur and today, nearly 70 years later, two of the streams, Otter Creek and Red Run, are being treated with limestone to neutralize their acidity and permit a brook trout fishery to exist. I doubt that acid deposition was causing the streams' acidity in 1934. It was probably the effects of logging and fires on the limited limestone resources of the watersheds. These were dissolved and leached out of the watershed and

the acid vegetation, soils, and geology that remained produced the acidity. When acid deposition started compounding the problem of stream acidification in West Virginia is not exactly known. Our first indication we had a major problem was in the early 1970s when there were periodic spring fish kills in the Cranberry River during the peak of the trout stocking. These were later related to precipitation events that were highly acidic (acid deposition) (Zurbuch 1993, 1984). This started research into development of a more efficient rotary drum system that could be used to treat the Cranberry's acidity (Zurbuch 1989). The field research was conducted in the headwaters of Otter Creek at the site of the original rotary drum station. During the field studies, pH was taken above the treatment site at the same stream location and using the same equipment that was used some 15 years earlier. A statistical analysis of the 2 sets of data showed a more than double increase in free acidity over the time span during the winter months. This increase was attributed to the effects of acid precipitation (Zurbuch 1984). Since the Otter Creek drainage lies just to the west of Canaan Valley, the Blackwater River watershed was experiencing the same acid deposition. During the evaluation of the Blackwater Rotary Drum station's effect on the stream chemistry, water samples were originally obtained above the treatment from the sluice that carried water to the drums. During heavy precipitation events we obtained abnormally low pH readings at this sampling station. It was discovered that Weimer Run, which enters the Blackwater River just above the sluice intake, was highly acidic and influencing the water chemistry in the sluice. The sampling location was moved out toward the center of the dam spillway to obtain a more representative sample of the river flow. Weimer Run has long been used as the primary water supply for the town of Davis. It was thought that there may be long-term pH and other chemistry records from the Town's water treatment plant that might show if it had always been acid or had turned acid sometime in the past. However, it was found that as a result of the 1974 passing of PL 93-523, known as the "Safe Drinking Water Act", the State monitoring of the Davis Water System and recording of the raw water intake chemistry did not start until 1986. Data were generally obtained on an annual basis. The 12 or so available pH analyses showed the stream had been acid since 1986 and had chemistry typical of an acid deposition affected stream (West Virginia Bureau for Public Health 2001). The headwater tributaries of Stoney River, a drainage just to the east of Canaan Valley, are also acid as a result of both acid surface mine drainage and acid deposition. Van Meter (1955) reported a water pH of 5.9 in the Stoney River Reservoir in August 1955. Many of these headwater tributaries drain into the reservoir and this study was done before surface mining had reached this portion of the watershed. A 1997 proposal was made by the State to Virginia Electric and Power Company (Dominion Energy) to add limestone sand to selected headwater tributaries of their Mount Storm power generation cooling lake (Zurbuch and Menendez 1997). It was estimated the treatment would increase alkalinity of both the old Stoney River Reservoir and the Mount Storm Lake and reduce or eliminate direct lake treatment with hydrated lime for acid neutralization. Besides reducing the cost to the company to treat water for power generation, the improved water quality in the treated tributaries and two impoundments should benefit the fish and other aquatic life. A partial limestone sand treatment was made in 2000 and the full recommended treatment considered for 2001. In addition to Weimer Run, other tributaries of the Blackwater River within Canaan Valley should be experiencing the effects of acid deposition, especially in their upper reaches. This was, in fact, found by Snyder et al. (1995) during their survey of Canaan Valley ponds and streams. The authors determined there were two predominate issues that affected the viability of aquatic populations in the valley. These were the effects of acid rain (deposition) in the headwater streams, and the changes in stream habitat to pond habitat by the activities of the valley's beaver population. I am in partial

agreement with these findings, but I believe there are other issues of equal importance, as will be discussed later.

First, I would like to discuss acid water treatment of a stream immediately to the west of Canaan Valley – Red Run. Red Run is a tributary of the Dry Fork River and is nestled next to the Blackwater Canyon on the western side of Canaan Mountain. Red Run is truly the gem of West Virginia trout streams. The upper section can be accessed from the "Loop Road" that runs from Canaan Heights to Blackwater Falls State Park. Use the Canaan Heights access; you need a 4-wheel drive vehicle to come in from the Park end. About 3.2 km (2 miles) in the road crosses the very headwaters of Red Run. If you look immediately upstream you will see the upper limestone sand treatment site. Each year, usually in the spring, about 36.3 metric tons (40 tons) of limestone sand are dumped into the stream at this location. High water then distributes the limestone sand downstream mixing it with the natural silica sand of the stream where it slowly dissolves as it moves with the bed load of similar sized particles. Just beyond this crossing, the road forks. The right fork continues on the Blackwater Falls State Park, and the left fork follows Red Run down to its mouth, but is gated a few kilometers (miles) in. Just before you reach the gate you can see on the left, where the road is near to the stream, the lower treatment site. About 190 metric tons (210 tons) of limestone sand are annually placed in the stream at this location. The limestone sand used is nearly 100% calcium carbonate and has a very narrow particle size range. It was originally made for the glass industry, but now a sizeable amount is used to treat acid streams. While at the upper end of the stream there is a high concentration of limestone, it soon mixes with the natural materials, and becomes unnoticeable. The annual treatment is equal to the estimated annual dissolution of limestone in the stream. The first few year's treatments were more than twice the annual dissolution so there would always be enough limestone in the stream at the end of the annual treatments. In stream limestone sand treatment is about the least expensive method of treating acid streams. After placing the limestone in the stream the natural stream processes regulate the treatment. Research has shown the limestone constitutes only about 9% of the bed load of the sand size particles (Zurbuch et al. 1996). As the limestone particles are moved downstream they become smaller and eventually entirely dissolve. At the mouth of Red Run we would expect to find < 1% of the sand to be limestone. Research has also shown that acid deposition releases free aluminum ions into the stream that are highly toxic to fish. The dissolving of the calcium carbonate releases calcium ions that attach to the fishes gill receptors and block entry of the aluminum ions (Clayton et al.1998). A ratio of about 10:1 of calcium to aluminum ions is needed to protect the trout and other species in the stream. There is a very close correlation of free hydrogen ions to free aluminum ions in acid deposition affected water (Baker and Schofield 1982). This makes water analysis much easier since both free calcium and free hydrogen ion concentrations can be obtained in the field. The hydrogen ion concentration is simply obtained by converting a pH to its hydrogen ion equivalent. In some of our past surveys of acid water we would find brook trout successfully reproducing in low pH streams where we would normally not expect to find them. This may have been because there was enough calcium in the water to protect them from the dissolved aluminum present. It is recommended that dissolved calcium be added to standard water analyses of acid deposition affected water so the calcium/hydrogen (aluminum) ionic ratio can be calculated.

The preliminary research on the use of limestone sand was in Red Run by Jim Woodrum (deceased), a fisheries biologist with the WVDNR. This was followed by a West Virginia University graduate student study (Ivahnenko et al. 1988), in Red Run and Yokum Run of Shavers Fork, and then the definitive research on headwater tributaries of Shavers Fork of Cheat River (Clayton et al. 1998). The annual treatment of Red Run with limestone sand started in 1997. Before

this the stream was fishless for most of its length. Some fish were found at its mouth where it crossed some limestone strata. Native brook trout were obtained from Gandy Creek, a tributary of the Dry Fork River, and stocked in Red Run in 1997 and 1998. They were stocked in the headwaters and in the middle section of the stream. A few mottled sculpins *(Cottus bairdi)* and blacknose dace *(Rhinichthys atratulus)* were also stocked in the upper section and were obtained from the same source. The Blennerhassett Chapter (Parkersburg) of Trout Unlimited has taken special interest in the stream and has provided funding for limestone sand. Brook trout reproduction was found the first year following their introduction. Fish surveys have been conducted annually since1998 (WVDNR, Wildlife Resources Section, personal communication). The brook trout population has continued to expand and the blacknose dace and mottled sculpin have successfully spawned and move into the lower reaches of the stream. Red Run was placed under fly-fishing only and catch-and-release regulations in 1999 by the WVDNR.

I have fished Red Run from its mouth upstream a number of times in the last few years. Each year the fishing seems to get better. The best day this year I released 16 trout and lost 6. I discovered my dry fly hook had broken in two at the bend of the hook after not hooking a number of fish. The largest fish I caught that day was 254 mm (10 inches), with a number in the 203 mm (8-inch) range. I also caught smaller trout showing a number of age groups were in that part of the stream. A couple of weeks later I caught a 305 mm (12-inch) fish, the largest brook trout I have caught so far from the stream. Darell Hensley (Tory Mountain Outfitters) is really enthralled with Red Run. He fishes the upper section of the stream and says he has no problem taking a novice fly angler there and having them catch brook trout. Darell told me he has caught brook trout in the 381 mm (15-inch) range from the stream. One of my biologist friends corroborated this recently when he creeled a 368 mm (14.5-inch) fish from the center section of Red Run (S. Brown, WVDNR, personal communication). As discussed earlier, Red Run will probably not stabilize biologically until 10 years following start of the limestone neutralization. This means Red Run has another 5 years (2007) before the maximum productivity will be reached. It is hoped that the mottled sculpin, blacknose dace, and macroinvertebrate populations will also continue to increase so the brook trout will have a more than adequate food supply to supplement the terrestrial insects that supply much of their summer diet. If Red Run is a gem, it is probably a ruby because of the color of its water. Fishing it is like fishing in a vat of light red wine, and the flashes of a male brook trout in breeding coloration in the depths of one of its pools are truly spectacular. For most of its length Red Run is a series of plunge pools, and from a trout fisherman's perspective, one more beautiful than the previous. I fish the stream wearing chest waders, since many of the pools cannot be navigated without them. The scenery is also spectacular, and if you're not a trout fisherman, it's worth your time to view on a hiking trip. Most of the watershed is within the Monongahela National Forest except for its lower end. I believe the Forest Service should place the entire watershed is some type of protected category to preserve the stream and its biological resources. Perhaps the Forest Service, the West Virginia Division of Natural Resources, and Trout Unlimited could combine forces to see that this is accomplished.

RESETTLEMENT

Under "Settlement" I discussed the destruction of the brook trout fishery in the Blackwater River from the effects of logging and burning of its watershed. The final section of this paper is titled "Resettlement" because of the increase of human presence in Canaan Valley and the ominous threat of the Blackwater becoming a river without much of its summer flows and the little flow that remains being polluted. If this happens the fishery will be destroyed again, even if much of the

valley floor is now in a National Wildlife Refuge. There are increasing demands for the ground and surface water resources of the Blackwater River drainage, especially in its very headwaters in the southern portion of Canaan Valley. There is a finite amount of water available. But development has gone on as if there were no limit, and with little regard to the water requirements of the fish and other aquatic life of the river and its tributaries. Fresh water supply for man's needs is a worldwide problem and is affecting the United States in both the western and eastern states (Montaigne 2002). Canaan Valley water use presents a microcosm of events that threaten the Blackwater River as do water withdrawals from some of our Nation's largest rivers. Not only does the Colorado River barely makes it to the Gulf of California with any water in it, but last year even the Rio Grande dried up before it reached the Gulf of Mexico. I doubt that Blackwater Falls will go dry, but the flow may be so reduced, and the water quality compromised so badly that the canyon trout fishery will be destroyed. Global Warming, if indeed it is a fact, will compound the problem of providing adequate water for human needs in Canaan Valley and maintaining the amount and quality of water necessary for its aquatic ecosystems.

Kosar (1995) did a water resource analysis of Canaan Valley in the 1990-92 period and states in the Discussion that: *"In excess of one-third of available surface-water resources is being used during low flow period"*. The following year he used the report data as the basis for a U.S. Geological Survey publication (Kosar 1996). In that publication the data are reported only for an annual water budget, and the domestic withdrawals are minimized by pointing out that what is withdrawn is put back in. This may be true, but the water put back in is of a much different quality physically and chemically. In Kosar's study he also found the water level in some wells, during dry periods, dropped so low that the Blackwater River was actually recharging them. Low flow periods are often the most critical for aquatic organisms; it is especially true for the trout species. In many cases, especially during drought, the water temperature raises to or near the upper limit they can survive at. Survival often depends on the duration of the high temperature events, the amount of oxygen in the water, and in extreme conditions the availability of "refugia" for the trout. In Canaan Valley this refugia has been in the cooler tributaries and springs that provided lower water temperature and oxygenated water. There may also be spring outlets in the main Blackwater, although Harry Reed and Don Good do not remember observing such areas during their many fishing trips. In the Blackwater Canyon refugia may be at the mouths of tributaries, in spring outlets, or in highly oxygenated canyon water. If the water withdrawal from Canaan wells caused them to drop so significantly during drought periods, the output of the Valley's springs were also probably diminished. Some of Canaan Valley's best springs have been covered by man-made ponds, effectively eliminating trout refugia, and during critical summer months, warming the water and increasing removal of water from the drainage by evaporation. Canaan Valley State Park constructed a number of ponds on Mill Run and Club Run to provide snowmaking water during the ski season and irrigate the golf courses during the summer. Evaporation from the ponds, of the man-made snow, and transpiration of the watered grasses of the golf courses all increase the water removal from the valley's ecosystems. The U.S. Geological Survey measured dissolved oxygen concentrations in the Blackwater River as it leaves Canaan Valley in 1994 and 1995. They measured concentrations < 6 mg/L a number of times with readings as low as 3.7 mg/L (U.S. Geological Survey 1995). Trout generally require dissolved oxygen concentrations > 6 mg/L. I believe these low readings are the result of the de-watering of the river and the increased biological oxygen demand placed on the remaining stream flow by sewage treatment effluents. Freeland Run is probably the best trout-producing tributary of the Blackwater River still existing in Canaan Valley. We have documented brook trout successfully reproducing in it and believe that brown trout may

have also. Dr. Linda Butler, an Entomologist at West Virginia University, did a study of the aquatic macroinvertebrates of Freeland Run and found they showed the stream to be of exceptionally high quality. The first survey was in 1981 prior to introduction of chlorinated effluent from a sewage treatment plant. Two additional surveys were made, one in 1986 and one in1987, and after the treatment plant went into operation. These data indicated the treated sewage was having an adverse effect on the stream's macroinvertebrate population compared to what was present before operation of the treatment plant and the continued high quality population's upstream (Butler 1988, 1987, 1981).

Back to the concerns of Snyder et al. (1995) about Canaan Valley's beaver and the effects of acid deposition; Six beaver were reintroduced into Tucker County in 1936 after being exterminated by early settlers and trappers (Swank 1949). A little over 10 years later a 1947 Beaver Census found 74 active colonies in the County. I don't know how many beaver ponds there are now in Canaan Valley, but the beaver have coexisted with the valley's trout populations for over 60 years without too much problem. Dr. Ed Michael, who is very knowledgeable of Canaan Valley fauna, believes the beaver population has stabilized or is in a slight decline (E. D. Michael, West Virginia University, personal communication). Yes, they do warm the natural stream water and increase evaporation loss, but if they are a problem their numbers can be controlled by trapping or other means. It would be interesting to compare the surface area of beaver ponds to that of man made ponds in Canaan Valley. Acid deposition will continue to be a major problem for the foreseeable future. It is a national and worldwide problem that will have to be controlled in that arena. In Canaan Valley the headwaters of tributaries of the Blackwater River that are being acidified are amendable to treatment using instream placement of limestone sand. The overriding problem I foresee for the future of Canaan Valley is between its human population and its aquatic ecosystems, and the allocation and use of the valley's water resources. They are on a collision course, if they have not yet collided. It will require some wise and innovative thinking of State and National water resource managers to solve this dilemma.

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