



Seven Lakes and the Pike's Peak native (PPN): history and current disposition of a critical cutthroat trout brood stock

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Introduction

Recent advances in molecular science have allowed researchers to dig deeper into the heritage of Colorado's existing native cutthroat populations creating a debate over their actual origin (Metcalf et al. 2007, Behnke 2008). Metcalf et al. (2007) suggested that the stocking of hatchery produced fish was responsible for the apparent presence of fish with what they suggest is a greenback cutthroat trout genotype (LineageGB) west of the Continental Divide. Inspection of additional populations west of the Divide with amplified fragment length polymorphisms (AFLPs) suggests that the presence of this

genotype is much more pervasive than originally anticipated (Rogers 2008), and could reflect a more complex phylogenetic past that has been masked by recent hatchery activity. In an effort to help explain this paradox, the history of the Seven Lakes - one of Colorado's primary historic cutthroat trout brood lakes (Figure 1), was explored.



FIGURE 1: A Leadville National Fish Hatchery employee fertilizes trout eggs at the Seven Lakes in Pike National Forest circa 1913. This image appeared in the October 1914 edition of *American Forestry*.

History

Although natural lakes did occur on the south slope of Pike's Peak (Figure 2), the city of Colorado Springs set about enlarging the existing water supply by constructing dams on Middle Beaver Creek when they acquired the property in the late 1890s. The city of Colorado Springs first started diverting water from this drainage with a pipeline built in 1890. A congressional grant had already given the lands around what is now Lake Moraine (Figure 3) to the city of Colorado Springs, and a dam was completed there in 1891. In 1894 Boehmer Reservoir (Colorado Springs #2) was constructed on Boehmer Creek upstream of Seven Lakes. The city purchased Seven Lakes from a private owner in 1902 and construction of Mason Reservoir (Colorado Springs #4) and McReynolds Reservoir (Colorado Springs #5) followed shortly thereafter with both completed in 1905. Leaks in the dam on Mason Reservoir prevented it from being used as a water supply until 1915.



FIGURE 2: The Seven Lakes before dams were built in 1904-05. The view is toward the west from the slope of Almagne Mountain, then known as Bald Mountain or Mt. Baldy. Two buildings are visible to the right of the largest lake. Image courtesy of the Tutt Library Special Collection, Colorado College, Colorado Springs.

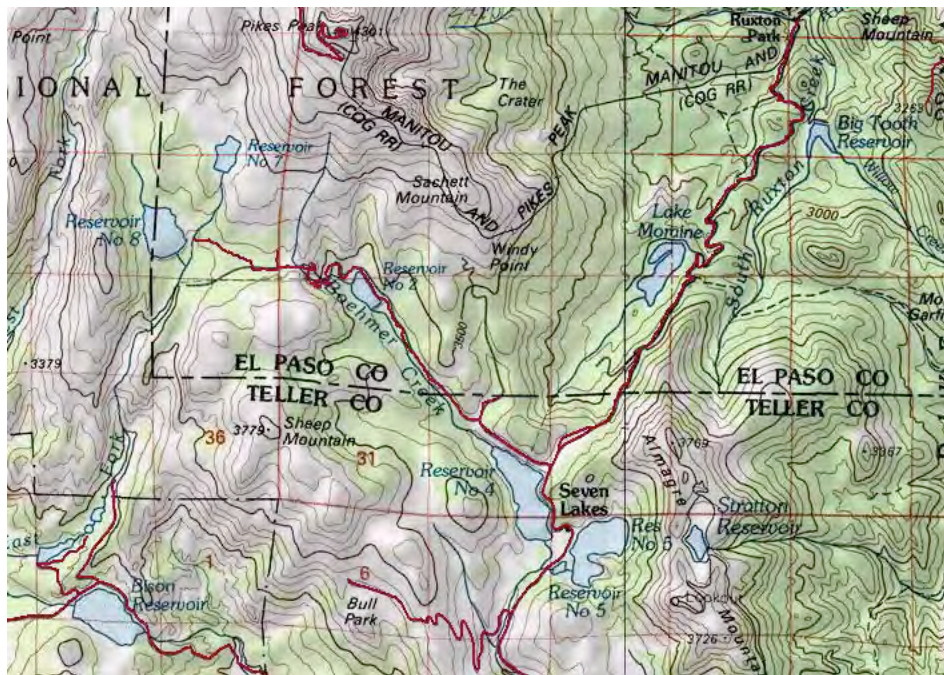


FIGURE 3: The Seven Lakes lie directly south of the summit of Pike's Peak and west of Colorado Springs. Lake Moraine sits northeast of Mason and McReynolds Reservoirs located in the lower center of the map.

The Seven Lakes were on popular route to the top of Pike's Peak, and owners constructed a hotel in the mid 1870s to attract tourists. Nearby waters already contained fish, as the January 2, 1891 edition of the White Pine Cone suggested that several hundred two and a half inch trout were stocked in the then fishless Lake Moraine. Newspaper articles from the Colorado Springs Gazette in 1878 and 1885 suggest that the Seven Lakes did not contain fish, but the owners intended to stock them. Plans to stock the lake were abandoned when a much shorter route up Pike's Peak was developed, forcing the hotel to shut its doors in 1890.

The Seven Lakes were stocked sometime between 1905 (when the dams on Mason and McReynolds Reservoirs were completed) and 1909, two years before the Leadville National Fish Hatchery began collecting eggs from adult fish. The August 19th 1908 edition of the Colorado Springs Gazette maintained that "water is again being stored in No. 5" suggesting that there might not have been much water (if any) immediately prior to that date. On August 14th, 1910, the same publication reprinted a letter from the Colorado Springs water superintendent to the mountain caretakers reminding them that fishing is prohibited in the city's reservoirs and that "that this applies more to our reservoir No. 5". For fish to have achieved a size of interest to anglers by 1910, they would likely have been stocked late in the summer of 1908, when eggs taken that year would have reached fingerling size appropriate for release. Leadville only collected eggs from the Grand Mesa Lakes in 1908, and the state collected cutthroat trout eggs from Emerald, Marvine, and Trappers Lake that year. It is unlikely that Emerald Lake was the source, as they were already hybridized with rainbow trout by 1908 (Van Velson 1985), yet rainbow trout alleles did not appear in the Seven Lakes populations. Given the sheer volume of eggs the state produced at Trappers Lake, it is likely that operation produced the founding eggs, however the state did buy fertilized eggs from the Grand Mesa Lakes in 1908. Amongst the State of Colorado stocking records is a request from 1908 by the City of Colorado Springs to stock Reservoir #5 (McReynolds Reservoir) with 15,000 trout, however there is no corresponding stocking record, nor do the local papers suggest that a stocking took place. The 1907-08 Biennial report of the Colorado State Game and Fish Commissioner states: "I have established a station at Russell's Lake, near Trinidad,...and one near Colorado Springs...We have stocked these field stations with fish and within a year or two more expect to be able to take spawn from such places." Other statements in the same paragraph suggest these stations were stocked with cutthroat trout. There are two stocking records for cutthroat trout into Boehmer Reservoir, as well as the above request for McReynolds Reservoir, from 1908. Perhaps one of these waters was the station the Commissioner was referring to. Both releases came from the Glenwood hatchery, again suggesting that Trappers Lake was the most likely source.

The first confirmed Federal stocking record into the Seven Lakes came from the Leadville National Fish Hatchery in 1911, when the "water company reservoirs" near the town of Clyde (Figure 4) were reported to have received fish. Hatchery employees from Leadville first started collecting eggs from Seven Lakes in 1911 so that could not have been the founding stocking event. Records suggest that the Leadville Hatchery sent an employee to the Seven Lakes to take spawn in 1911, 1912, 1913, 1917, and 1918. In

addition, eggs for Leadville Hatchery production of cutthroat trout also came from Yellowstone Lake, Wyoming and Antero Reservoir in South Park during the 1910s. It has been suggested that the latter may have been introgressed with rainbow trout and were not used at Leadville until 1917 (Wiltzius 1985). In fact, the Bureau of Fisheries reports specifically list collection of rainbow trout eggs from Antero Reservoir in 1914, 1915, 1916, and 1917. The only direct evidence of rainbow trout ever being released in the Seven Lakes comes from a newspaper account and stocking record in the Colorado Springs Gazette on August 20, 1911 that indicates rainbow trout were placed in Mason Reservoir. Molecular evidence suggests that these fish did not pass alleles on to the population that persisted until the 1996 reclamation (see below).



FIGURE 4: The thriving community of Clyde in 1920 (left) with what appear to be fish ponds in the foreground. Although they are not identified as such, the document previously suggests that pictures “from the early 1900’s show Upper Clyde with several buildings and manicured fish ponds that were stocked and where, reportedly, one could catch a beautiful trout, and take it to the restaurant to be cooked and served.” (from the Mrs. W. D. Corley Collection). The ponds persist today (right), but the buildings are gone.

Clyde was the closest town to the Seven Lakes and a stop on The Colorado Springs and Cripple Creek District Railroad, which operated between 1901 and 1920. The presence of the railroad in close proximity to Seven Lakes allowed for ease in transporting fish to this location. To further complicate matters, the Glen Rock Hatcheries Company operated in Clyde during the 1910s and could also have been a source of fish for Seven Lakes. Several modern cabins are all that can be found in Clyde today.

Former aquatic senior biologist Don Wurm’s first recollection of spawning cutthroat trout on Pike’s Peak came in 1957 when he was a young game warden in Pueblo. He participated in a wild spawn operation on McReynolds Reservoir. He did not recall if any egg take operations occurred prior to that point, but did believe that Yellowstone cutthroat trout were stocked at the time or just before then. He thought that Yellowstone cutthroat trout were introduced between 1954 and 1956 in both McReynolds Reservoir

and Mason Reservoir. Snake River cutthroat trout were later added to the mix, but managers decided that was a bad idea, removing them when they were subsequently encountered.

Given the history of Yellowstone cutthroat trout introductions, reclamation of the entire drainage was planned. The City of Colorado Springs drained Boehmer Reservoir in 1984 to conduct repairs on the dam. The Colorado Division of Wildlife (CDOW) took advantage of the opportunity to reclaim the remaining pool as well as the stream and tributaries that feed it by applying powdered rotenone in September of 1984. A new population of fish was founded from an Arkansas basin greenback cutthroat trout that was propagated at the Saratoga National Fish Hatchery in Wyoming, and the Columbia Lab in Denver at the direction of the Greenback Recovery Team. These fish were derived from wild spawn operations performed at Lytle and McAlpine Ponds (Young et al. 2002) at Fort Carson. These two Fort Carson sources were established by translocating fish from a putative aboriginal population of greenback cutthroat trout in Cascade Creek in the Huerfano River drainage of southern Colorado in 1980 (McAlpine Pond) and 1981 (Lytle Pond). Reclamation efforts then moved downstream, clearing Boehmer Creek and Mason Reservoir out in 1996, and McReynolds Reservoir in 1999. Adults salvaged from McReynolds Reservoir prior to the reclamation were moved to Lake Moraine, but it is doubtful that any remain today.

Recent status

Winterkill continues to be a problem in the shallow waters of Bighorn Reservoir (Colorado Springs #7) and Wilson Reservoir (Colorado Springs #8), and they remain fishless. No recent stocking has occurred in these two reservoirs (at least since 1977), but Boehmer Reservoir was stocked with greenback cutthroat trout raised at Saratoga from Cascade Creek origin fish at Lytle and McAlpine Ponds in 1985, 1986, 1987, and 1988. No recent stocking of Mason Reservoir has occurred, but eggs derived from the spawn operation on Mason Reservoir (PPN) were released into McReynolds Reservoir from 1974-1998 to allow for continued egg takes there. This lake does not have a good spawning stream running into it like Boehmer Creek into Mason Reservoir (Figure 5), so it is unlikely that it can support natural recruitment. Evidence of past egg takes persists in McReynolds Reservoir, as rusted rolls of razor wire deployed to discourage anglers from fishing to aggregations of ripe cutthroat trout remain.

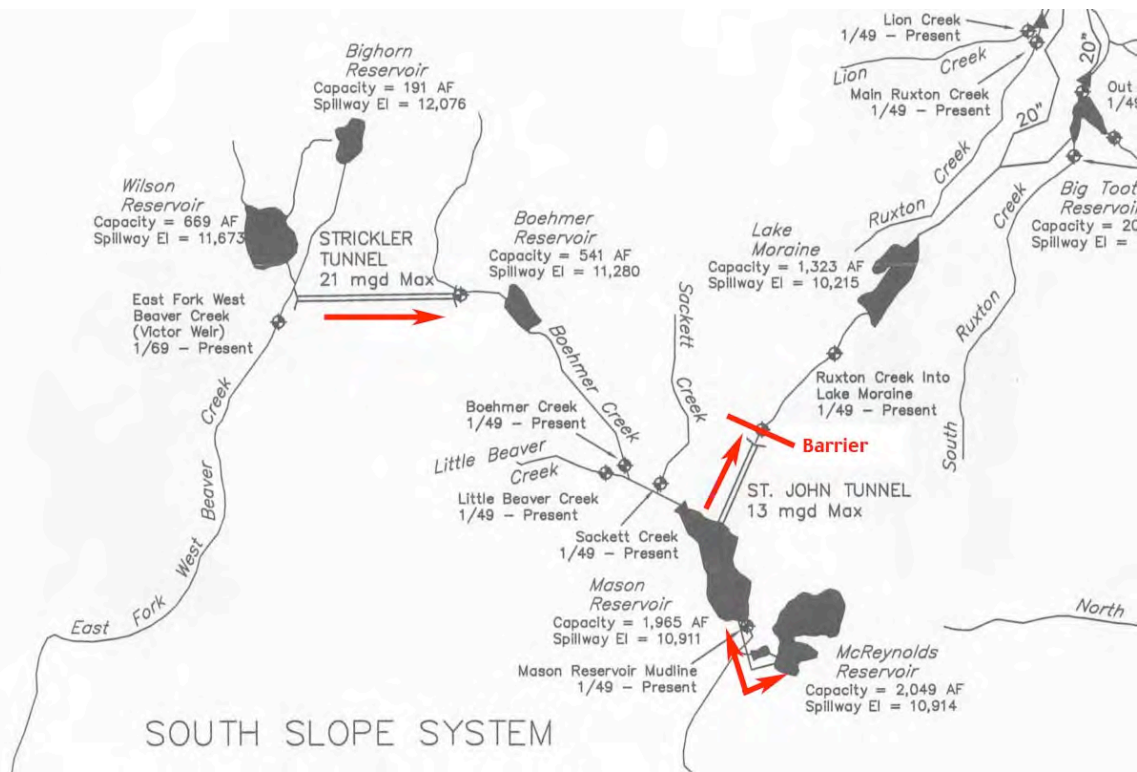


FIGURE 5: Schematic depicting current diversion of water flow out of the Seven Lakes basin. Direction of red arrows suggests direction of possible fish movement. The barrier shown precludes movement upstream from Lake Moraine into Mason Reservoir. Map courtesy of the Colorado Springs Utilities.

Reclamations on the south slope of Pikes Peak in Mason and McReynolds Reservoirs followed genetic reports that suggested introgression with Yellowstone cutthroat trout in McReynolds Reservoir (56%) and mild introgression with rainbow trout (6%) in Bohmer Reservoir (Kanda and Leary 1999). Those authors used starch gel electrophoresis to examine genes coding for proteins in muscle, liver and eye tissue for that study. These results were contrary to those found by Proebstel (1995) who suggested that meristic and morphological measurements showed they were essentially pure greenbacks in Bohmer Reservoir, with no indication of rainbow trout alleles based on meristic and spotting characteristics. Inspection of the cytochrome B mitochondrial gene also indicated no non-native trout alleles in Bohmer Reservoir (Proebstel et al. 1996). In 2001, Shiozawa and Evans examined two mitochondrial and two nuclear genes in 27 fish from Bohmer Reservoir (Evans and Shiozawa 2001). They documented introgression with Yellowstone cutthroat trout (7.4%). This was confirmed by Metcalf et al. (2003) after examining the cytochrome oxidase 1 mitochondrial gene that suggested Yellowstone cutthroat trout alleles were present (8%). Both studies did not find evidence of rainbow trout alleles to corroborate the findings of Kanda and Leary (1999).

During the drought of 2002, the lakes were almost drained completely, and the CDOW took advantage of the low water conditions to remove all fish in the entire system,

eliminating any stragglers that might have been left behind after the previous reclamations. At the time of this report, both Boehmer and Mason Reservoirs remain fishless, while McReynolds Reservoir is home to progeny of a blended brood stock (GBA) derived from adult cutthroat trout taken from Graneros Creek, South Apache Creek, and North Taylor Creek that were stocked out in 2004 and 2005. These three donor streams were considered to be pure greenback cutthroat trout populations at the time however that designation has recently been called into question. Metcalf et al. (2007) suggested that South Apache and Graneros Creek fish are derived from Colorado River cutthroat trout stock. More recent testing with AFLPs indicates that South Apache and North Taylor Creek also display nuclear genetic fingerprints more similar to reference populations representative of the lineage Metcalf et al. described as Colorado River cutthroat trout (LineageCR, similar to Trappers Lake fish) than what they described as greenback cutthroat trout (LineageGB, similar to Severy Creek fish), though confusion over what these two lineages really represent remains (Rogers 2008).

Although we don't have access to the original Pike's Peak native (PPN) brood stock, a search for wild populations founded from them is ongoing. Rock Creek in South Park near Jefferson was thought to be a promising candidate. Though no barrier to migration is readily apparent, the downstream prolific brook trout population does not seem to be able to invade the upstream cutthroat trout habitat. Until recently, a one time stocking event of 500 fingerling PPN from the Mt. Shavano Hatchery in 1984 was assumed to have founded this population. Inspection of this population with AFLPs (Rogers 2008) suggest a match with the four Colorado River cutthroat trout reference populations used in 2008 (Figure 6). Those reference populations are distributed across the range of Colorado River cutthroat trout, and include Williamson Lake #3 (original Trappers Lake fish), East Fork of the Piedra River (Hinsdale County), South Fork of Slater Creek (Routt County), and the East Fork of Parachute Creek (Garfield County). The lack of any evidence for introgression with Yellowstone cutthroat trout was surprising. In light of the AFLP test results, a more thorough search of historic records did in fact reveal a stocking event from the Leadville National Fish Hatchery in 1912 which could have been progeny from the 1911 Seven Lakes egg take. The fact that these fish look to be LineageCR is then consistent with the above discussion regarding the heritage of the early Seven Lakes fish.

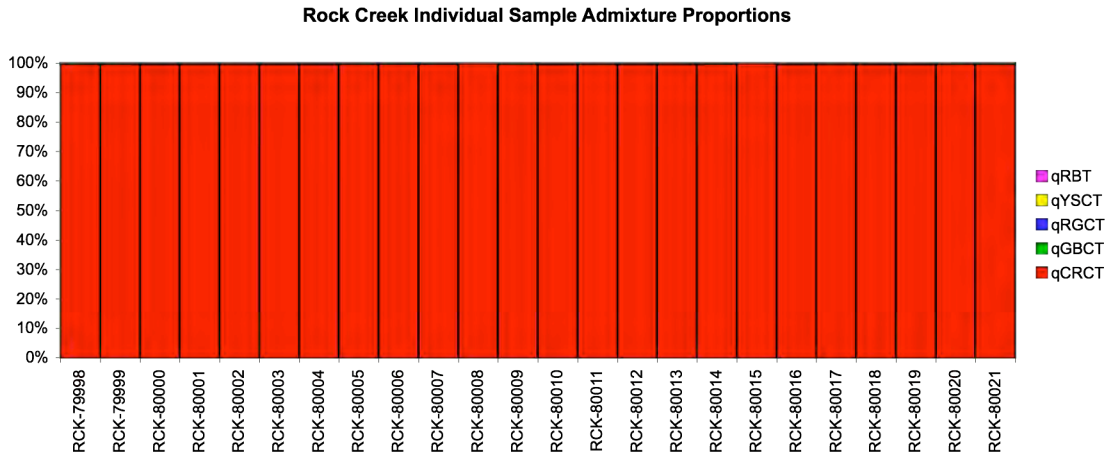


Figure 6: AFLP results interpreted with program STRUCTURE for 24 fish collected from Rock Creek (CDOW water code #30661) in South Park suggest a perfect match with Colorado River cutthroat trout 2008 reference populations.

Conclusion

The Seven Lakes did indeed figure prominently in the early years of fish production in Colorado, and historic stocking records suggest that progeny derived from that operation have been scattered across the state. It appears however, that in fact these fish were likely never pure greenback cutthroat trout, but rather transplants from the West Slope – most likely derived from the spawn operation at Trappers Lake. As such, the pervasive stocking of Seven Lakes fish does not explain the preponderance of LineageGB fish that can now be found on the West Slope of Colorado.

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In addition, Chris Kennedy consulted the State of Colorado cutthroat trout stocking records located at the State of Colorado Archives for some of the information presented in this report. Records from 1899 to 1926 for all waters were researched. Federal cutthroat trout stocking records located in the U. S. Fish Commission Annual Reports from fiscal years 1892 to 1918 (excluding 1911) were also examined, as were the Leadville National Fish Hatchery Superintendent's annual reports and State of Colorado Game and Fish Commissioner biennial reports.