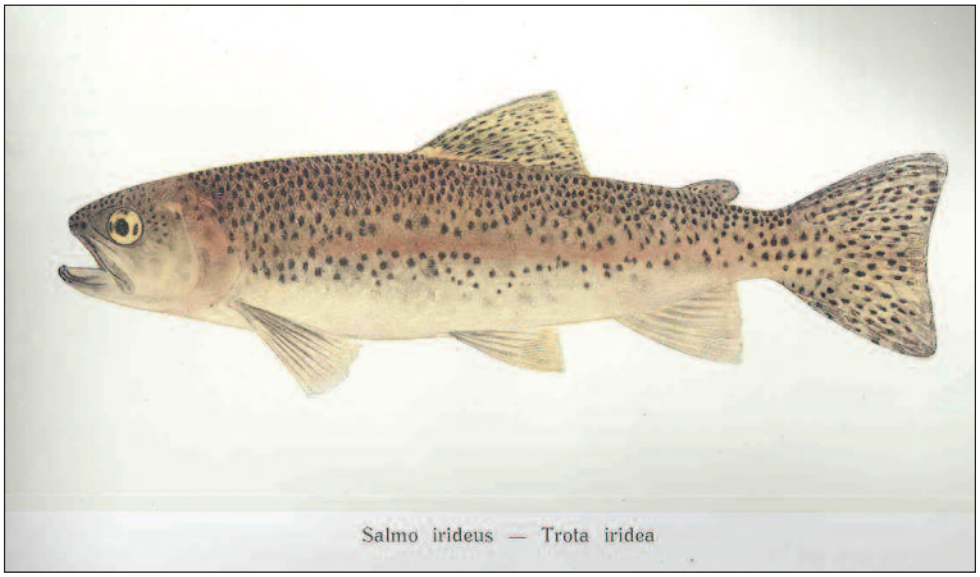
How Rainbow Trout Came to Missouri (and Your State Too)

Part III: Rainbow Trout from the McCloud

by R. W. Hafer



A 1916 illustration of Salmo irideus. *From the University of Washington Libraries Freshwater and Marine Image Bank, https://digitalcollections.lib.washington.edu /digital/collection/fishimages/id/35666/rec/1. Accessed 28 January 2021.*

This article is the final installment of a three-part series that explores how rainbow trout found their way from Northern California to nearly every one of the contiguous forty-eight states. Part I, "The Beginnings," appeared in the Spring 2021 issue; Part II, "The Great Experiment," ran in Summer 2021.

The year was 1879. The Great Experiment—shipping Pacific salmon from the McCloud River in Northern California to locales across the country—was ongoing, but the incoming data increasingly indicated that it was an exercise in futility. In Missouri, the program all but ended in the early 1880s, as was likely true in other states. So why mention 1879? In July of that year, U.S. Fish Commissioner Spencer Baird sent a message to Livingston Stone, the director of salmon operations on the McCloud River that was clear in its intent: find a suitable location on the McCloud River for the sole purpose of collecting the eggs from what Stone called black-spotted trout, or *Salmo iridea*, and what some called California brook trout. Baird's 1879 directive and Stone's subsequent efforts mark the effective beginning of the government's newest experiment: transplanting rainbow trout from Northern California to the rest of the United States and the world.

Let me be clear. This will not be a debate over exactly which kind of trout Stone was shipping to others; I'll leave that to the experts.[1] Henceforth I will refer to the fish Stone caught and whose eggs he shipped simply as rainbow trout. And I will only dip a toe into the debate over *when* the first rainbow trout were first shipped from California to others back East.

It is not a stretch to believe that this pivot to rainbows occurred because the salmon experiment failed. Baird was a shrewd political operative, always looking to expand the activities of his commission and increase funding from Congress. Because "their personal reputations and the reputation of the agency were on the line . . . neither Stone nor Baird was about to admit failure and give up."[2] The rainbow experiment also aligned with the ideas laid out in the resolution that created the U.S. Fish Commission—namely, the push to increase the fish population as a food source.[3] Could rainbows be farmed like other livestock in a multitude of locations across the country? As it turned out, the ability to propagate rainbows on a mass scale at hatcheries throughout the country was so successful that collecting rainbow eggs in California was made redundant less than a decade after it began.

My purpose here is to focus on how rainbows got from California to other parts of the country. In the end, I'll use Missouri's experience to illustrate how the program was conducted at a more local level. My guess is that Missouri's experience is similar to that of many other states. And my story ends in 1900;

POSITION OF HANDS IN STRIPPING A SMALL TROUT.

From Third Annual Report of the Commissioners of Fisheries, Game and Forests of the State of New York *(New York and Albany: Wynkoop Hallenbeck Crawford Co., Printers, 1898), 196.*

I leave the development of U.S. fish culture as it relates to the rainbow—the good, the bad, and the ugly—to others.[4]

Finding the Right Spot

Stone and two others set out on horseback from downstream at the Baird Station (where the salmon operation was located) on 25 July 1879. Unlike his earlier attempt to establish the salmon hatchery, finding trout was not the problem—they were abundant throughout the McCloud. After traveling upstream to scout possible sites, none were chosen (for various reasons) until, on the return leg, they came to Crook's Creek (now Green's Creek), about 4 miles upstream from the Baird Station. Stone immediately knew that this was *the* spot.[5] A feeder creek into the McCloud was running cold and clear in July, indicating a spring-fed source. The site was open and flat enough to construct holding ponds, and there was an ample supply of raw materials with which to build a hatching house and quarters. Other necessities could be brought up from the Baird Station.

Stone supervised the construction of a hatching house and the digging of rearing ponds. Launching the trout station was not without some drama. At one point, a member of the crew was held at knifepoint by a few local Native Americans. Although released unharmed, the message was clear: Stone and other settlers were trespassers, a viewpoint that Stone was not unsympathetic to. Settlers moving into the McCloud River valley disrupted the compact that Stone had reached with the local Native Americans when establishing the salmon-taking operation. Stone observed that far too many settlers "take up a claim, burn the Indian rancheries, shoot their horses, plow up their graveyards, and drive the Indians back into the hills, the ultimate result of which must be approximate starvation."[6] Not a complimentary assessment of how the West was won. In a moment of melodrama, Stone reported to his fellow fish culturists, especially those back East, that "these incidents merely show that with tarantulas, scorpions, rattlesnakes, Indians, panthers, and threats of murder our course here is not wholly over a path of roses."[7]

Taking Trout Begins

Collecting rainbow trout eggs used a different approach than that to obtain salmon eggs downstream at the Baird Station. The process used on salmon was to net or trap them, club them into submission, strip their eggs or milt, and dispose of the carcasses. In contrast, rainbows were caught using setlines, essentially cords about 150 to 175 feet in length, with finer vertical drop lines spaced every 5 feet. The drop lines, about 2 feet in length, had a hook at the bottom that was baited. The most successful bait, perhaps ironically, was salmon eggs. The setlines were spread across the river, and the baited hook sat on or hovered just above the bottom of the stream until taken by a passing rainbow.

"Breeders" were caught using setlines and transferred to holding ponds. Once the females were "ripe," the eggs were "pressed" from them into a pan. After fertilizing the eggs with milt similarly extracted from the male trout, they were placed in the hatching house and aged. When ready, the egg trays were packed into crates and shipped to their assignees. Unlike salmon, the trout were not sacrificed in this process, but put back into the holding ponds or the river. As for the shipping part, they employed similar contrivances used to transport salmon eggs, which were described in Part II of this series.

Shipping Trout

The trout-taking station on the McCloud became fully operational in late 1879. Fish caught during the summer populated the rearing ponds. Stone estimated that he had some 3,000 mature trout estimated to weigh an average of about 3 pounds each. He boasted that by year's end they had "the finest collection of live trout in America, and probably the world."[8]

The first rainbow trout eggs were harvested on 12 January 1880. At intervals between then and the end of May, about 388,000 rainbow trout eggs were collected. Of these, 261,000 were shipped to hatcheries back east, and 68,000 were hatched and the fry returned to the McCloud.[9] Missouri was an early recipient of McCloud eggs, with Missouri Fish Commissioner I. G. W. Steedman taking delivery of 39,000 eggs in May 1880.

An Aside: Who's on First?

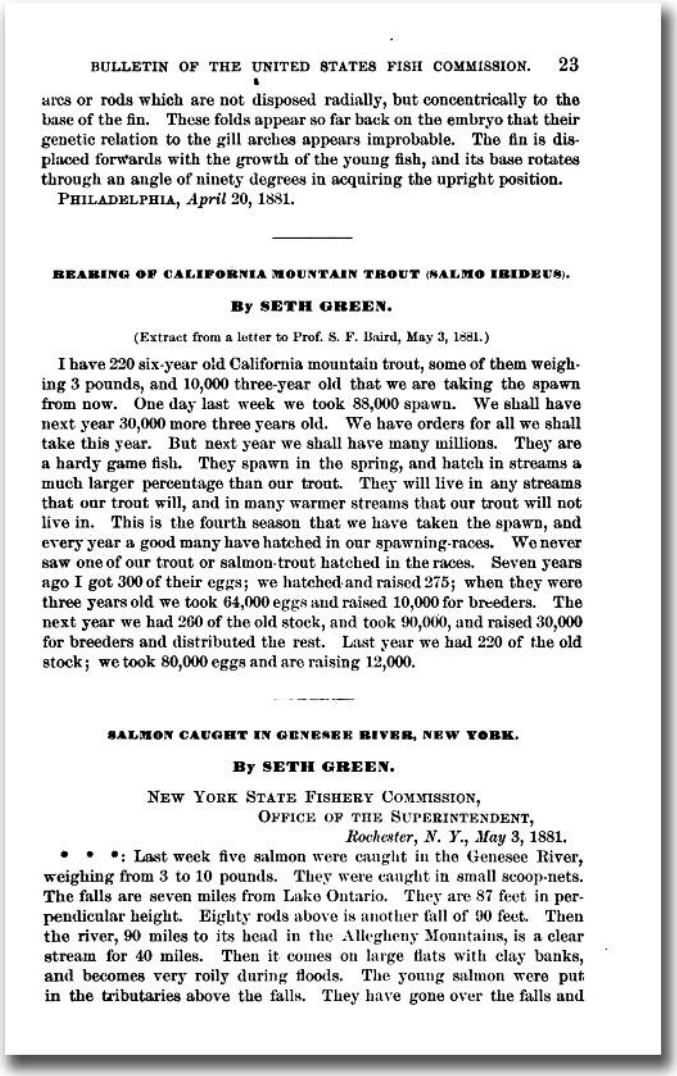
Maryland was the first state to receive rainbow eggs and plant fry from the McCloud operation.[10] Stone's records show that his very first shipment of trout eggs was sent on 30 January 1880, destined for the Druid Hills hatchery in Baltimore. Maryland Fish Commissioner T. B. Ferguson, in his report, tells us that on 15 April 1880, fry hatched from these eggs were set loose in a tributary of Gwynn's Falls and a pond near Buckeystown.[11] Although Maryland may have been the first state commission to release rainbows from California, there were precedents.

Before the creation of the California Fish Commission, the Ornithological and Piscatorial Acclimatization Society of California was formed in 1870. Headquartered in San Francisco, it was part of a worldwide movement of so-called acclimatization societies, the first of which appeared in France in 1854, with similar societies soon popping up in England, Germany, and other places. The California group soon established a hatchery program to experiment with fish propagation.[12] We know, for example, that in 1871 they took delivery of 10,000 fertilized brook trout eggs from none other than Seth Green's hatchery in New York.[13] They also experimented with propagating rainbow trout eggs from fish taken from local waters in the San Francisco Bay area.

The group's activities were not unknown outside of California. Many members of the society were transplants from the East, and many of them were well acquainted with the work of fish culturists such as Seth Green. Indeed, in the spring of 1875 the society shipped 500 rainbow eggs taken from the San Francisco Bay area to Seth Green at his Caledonia hatchery, fish that Green referred to as "California mountain trout."[14] Because the state of New York had purchased Green's hatchery by then, technically this 1875 shipment of rainbow eggs from California to New York makes it—not Maryland—the first state to receive rainbow trout eggs from California.[15]

Or was it? J. B. Campbell, who owned a ranch on the McCloud, shipped trout eggs from his personal hatchery to others outside of California before Stone set up his operation. In a letter from Campbell to Commissioner Baird published in the 1881 U.S. Fish Commission's *Bulletin*, Campbell tells the commissioner that he arrived in the area in 1855 and had "watched the salmon and the trout during their spawning more closely than any other man in this part of the country."[16] Apparently, Campbell shipped trout eggs—probably quite a small quantity—to individuals back East, perhaps as early as 1874, although that is disputed.[17]

Exactly when rainbows were first exported from California remains murky. What we do know is that Seth Green took shipment of rainbow trout eggs from Campbell in 1878 to be reared in his Caledonia, New York, hatchery.[18] Technically, then, it is likely that one of the first rainbow trout brood stock established (and the progeny planted in local rivers) outside of its native range was at Green's Caledonia hatchery.[19] This is Robert Behnke's position.[20] But what kind of rainbows? That his brood stock was not from McCloud rainbows but Bay Area rainbows is suggested by a letter from Seth Green to Baird, also published in the *Bulletin of the United States Fish Commission for 1881*. Green says that he has "220 six-year-old California mountain trout . . . that we are now taking the spawn from."[21] Behnke points out that Green made the distinction between mountain trout and fine-scaled trout, so Green's letter suggests that he probably was propagating steelhead trout. Importantly, Green goes on to tell Baird that "seven years ago" he received a shipment of 300 trout eggs and from these eggs they had 10,000 fish in their brood stock by 1881.[22] Doesn't this mean that Green received the shipment in 1874? Whether mountain trout, steelheads, or fine-scaled trout and in what year it all began are issues I leave to others more diligent than I to sort out.



BULLETIN OF THE UNITED STATES FISH COMMISSION. 23

arcs or rods which are not disposed radially, but concentrically to the base of the fin. These folds appear so far back on the embryo that their genetic relation to the gill arches appears improbable. The fin is displaced forwards with the growth of the young fish, and its base rotates through an angle of ninety degrees in acquiring the upright position.

PHILADELPHIA, *April* 20, 1881.

BEARING OF CALIFORNIA MOUNTAIN TROUT (SALMO IRIDEUS).

By SETH GREEN.

(Extract from a letter to Prof. S. F. Baird, May 3, 1881.)

I have 220 six-year old California mountain trout, some of them weighing 3 pounds, and 10,000 three-year old that we are taking the spawn from now. One day last week we took 88,000 spawn. We shall have next year 30,000 more three years old. We have orders for all we shall take this year. But next year we shall have many millions. They are a hardy game fish. They spawn in the spring, and hatch in streams a much larger percentage than our trout. They will live in any streams that our trout will, and in many warmer streams that our trout will not live in. This is the fourth season that we have taken the spawn, and every year a good many have hatched in our spawning-races. We never saw one of our trout or salmon-trout hatched in the races. Seven years ago I got 300 of their eggs; we hatched and raised 275; when they were three years old we took 64,000 eggs and raised 10,000 for breeders. The next year we had 260 of the old stock, and took 90,000, and raised 30,000 for breeders and distributed the rest. Last year we had 220 of the old stock; we took 80,000 eggs and are raising 12,000.

SALMON CAUGHT IN GENESEE RIVER, NEW YORK.

By SETH GREEN.

NEW YORK STATE FISHERY COMMISSION,
OFFICE OF THE SUPERINTENDENT,
Rochester, N. Y., May 3, 1881.

* * *: Last week five salmon were caught in the Genesee River, weighing from 3 to 10 pounds. They were caught in small scoop-nets. The falls are seven miles from Lake Ontario. They are 87 feet in perpendicular height. Eighty rods above is another fall of 90 feet. Then the river, 90 miles to its head in the Allegheny Mountains, is a clear stream for 40 miles. Then it comes on large flats with clay banks, and becomes very roily during floods. The young salmon were put in the tributaries above the falls. They have gone over the falls and

An excerpt of Seth Green's letter to Commissioner Baird. From Bulletin of the United States Fish Commission for 1881 *(Washington, D.C.: U.S. Government Printing Office, 1882), 23.*

Rainbow Trout: The Wonder Fish

Stone not only procured and supplied rainbow trout eggs, but he and his assistants (most notably Myron Green) added much to our knowledge about the rainbow's characteristics through numerous experiments conducted at the station. For example, data were collected on how hatching times of rainbow eggs varied with changes in water temperature and the amount of sediment in the water. The evidence indicated that not only were rainbows hardy to water variations—temperature and clarity—but they grew much faster than brook trout and were not, unlike their eastern cousins, cannibalistic. This information added to the growing body of evidence that rainbow trout were much more

adaptable to varied conditions, both in a hatchery setting and in the wild, than brook trout.

Evidence was pouring in showing just how robust the rainbow was. In a memorandum published in the *Bulletin of the United States Fish Commission for 1881*, we find that in late November 1881 the commission in Washington, D.C., received an 8-inch specimen rainbow (in alcohol). It came from S. G. Worth, commissioner of agriculture for the state of South Carolina. The trout apparently was a survivor of a planting from early 1880 and was caught in August in Mill Creek, a tributary of the Catawba River. If rainbows could survive in South Carolina, successful introductions elsewhere seemed assured.

Collecting rainbow eggs and shipping them faced a few hurdles. Stone's records for 1881 show a dip in production, to "only" 261,000 eggs. The decline occurred because flooding washed mud into the trout ponds, killing much of the brood stock. A year later, however, production bounced back to 337,500. Stone's accounting of the operations in 1882 stated that "fishing for parent trout in the river is now being continued, in order to add to the stock already in the ponds, which probably contain at present about three tons weight of healthy and fine-looking fish."[23]

From this point on, the annual records of the trout operation become repetitive—the number of eggs collected, shipped, etc.—so little additional insight is gained by reciting the numbers year by year. However, events that were equally important in the development of rainbow trout propagation and distribution were occurring.

Advertising Success

With the Great Experiment waning, by the mid-1880s the commission was eagerly publicizing success stories about its activities to transplant rainbows. Fry hatched from McCloud trout eggs were finding their way into streams, rivers, and ponds across wide swaths of the country. As rainbow trout became more commonly recognized, an increasing number of individuals with hatcheries experimented with propagating them and, no doubt, introducing them privately into local waters. To publicize the adaptability of the rainbow—and thus their wisdom in undertaking the exercise in the first place—the U.S. Fish Commission published testimonials from private individuals and state hatchery managers in its *Bulletin*. This was done to elicit more involvement, but also to show the public and especially Congress that the failed salmon program should not cast too long a shadow on the commission's abilities.[24] Let's consider just a few of the stories—all letters addressed to the commissioner—touting the rainbow trout.

Wakeman Holberton from Ohio relates in a letter dated 9 March 1883 that "California trout that we put in [a stream near Cleveland] in 1881 were doing finely last year, and had already grown to the size of four inches."[25] Roland Redmond of New York wrote to request an additional shipment of rainbow eggs to the South Side Club, an association of fishing enthusiasts located in New York City. The club's initial shipment of eggs in 1880 were hatched and planted, some reaching 22 inches and weighing 3 pounds. Needless to say, the club was once again "anxious to stock one of its ponds with this [rainbow trout] fish."[26]

Other letters presaged the future of the rainbow trout in America. S. B. Smith from Zanesfield, Ohio, described in a letter dated 23 January 1885 the history of his personal trout hatchery, only one of two in the state (to his knowledge). In 1882 he ordered 1,000 rainbow trout fry from a hatchery in Cassopolis, Michigan, and soon ordered more fry, 115 yearlings, and 30 two-year-old fish. He also procured nine three-year-old trout from a Mr. Annin of Caledonia, New York, probably from Seth Green's hatchery. Smith recounts that most of the yearlings escaped in 1883 into the Mad River and that in only two years some of these now sizable escapees were being caught by locals. To bolster the notion of the rainbow's robustness, Smith told the commissioner that "they had done better in Mad River than in my ponds, although I had fed those in the ponds daily."[27]

There are more similarly effusive testimonials (and only positive ones seemed to find their way into the *Bulletin*), but I think you get the idea. What makes these endorsements of interest is the fact that they validate the perception that rainbows are easy to hatch and raise. This evidence corroborated Baird's promotion of rainbows not only as a sport fish but also a food fish. In addition, the letters encouraged the idea that individuals, not just the government, could be counted on to expand the distribution of rainbows in particular and fish in general.[28]

Some of the letters were prescient. A good example is the letter from B. E. B. Kennedy, a member of the Nebraska Fish Commission, to Baird, requesting *another* shipment of rainbow eggs from the McCloud operation. The first lot was received in 1883 and had grown to some size in their rearing ponds. It seems, however, that the whole lot was stolen one night, so replacements were needed. But here is why this letter is so predictive: "With one other lot of 10,000," Kennedy writes, "*we hope to establish ourselves securely in the production of all we need for future operations*"[29] (emphasis added). You see, the Nebraska commission—like Seth Green in New York and doubtless many others across the country—were finding that with a starter set of eggs from the McCloud, they could establish their own brood stock from which they could extract eggs, fertilize them, and stock the resulting fry into streams and ponds in Nebraska, or Missouri, or whatever state the hatchery was in. It was like a switch had been thrown on the country's rainbow trout–producing machine. But this achievement came with a cost: there was no longer any need for Stone's trout station on the McCloud.

Success Dooms the McCloud Station

Marshall McDonald was the chief assistant commissioner to Baird in the mid-1880s. In his 1886 "Report on Distribution of Fish and Eggs," the commission's distribution of trout and various species of fish during 1885 and 1886 is detailed.[30] The report describes how the introduction of rainbow trout throughout the country quickly evolved from depending on McCloud as the sole source of eggs to acquiring them from the federal hatcheries at Northville, Michigan, and Wytheville, Virginia.[31] At both hatcheries, the majority of eggs hatched in the mid-1880s were used to rear brood stock, although some eggs were sent to "applicants," one of which was the Missouri state hatchery in St. Joseph. Even though the McCloud operation produced more eggs than the other two hatcheries, it would not for long.

McDonald's report foretells the end of Stone's trout-taking operation in another way. By this time (1886), even though rainbows seemingly could be propagated almost anywhere, the general inability to establish self-sustaining populations of rainbows from stocking proved to be "disappointing and wholly incommensurate to the expenditure incurred."[32] It's not that there weren't some success stories out there—Missouri's success was advertised as one example—but too often the fry were easy pickings for the abundant "predacious fish of small size" who "prey upon the [fry] so assiduously that few if any escape capture."[33] The trout-stocking program, in other words, was better at feeding the native fish than establishing a self-sustaining population of rainbows.

The commission's rainbow program thus took a significant and lasting detour

in 1886, which I believe reflects McDonald's influence on commission policy. Because rainbows could be easily propagated and quickly raised to some size in hatcheries, the U.S. Fish Commission shifted from stocking fry to planting larger fish. Eggs from brood stock would be hatched out in the federal hatcheries, raised to a size of 4 to 6 inches, and then shipped out for stocking. This, of course, necessitated an alternative mode of shipping, which the dedicated fish car, like the one shown below, made possible.[34]

Even though the loss in hatchery rearing was not negligible, "it is probable," MacDonald argued, "that one pair of yearling trout will contribute as much towards the stocking of the waters as would a plant of several thousand fry."[35] Thus, in 1886, more than 4,600 rainbow trout ranging from 4 to 7 inches were distributed from the Northville hatchery to rivers in Indiana, Ohio, and Michigan. From Wytheville, similarly sized rainbow were sent to the headwaters of the Shenandoah River in Virginia, to tributaries of the Potomac River in Maryland, and to numerous spring-fed ponds in Virginia, Maryland, and Tennessee. From this point on, generation after generation of rainbow trout would be propagated in hatcheries far from Northern California and used to stock streams, rivers, and ponds—public and private—around the country. The genetic connection of trout swimming in the nation's waterways to their McCloud ancestors would become more and more tenuous.

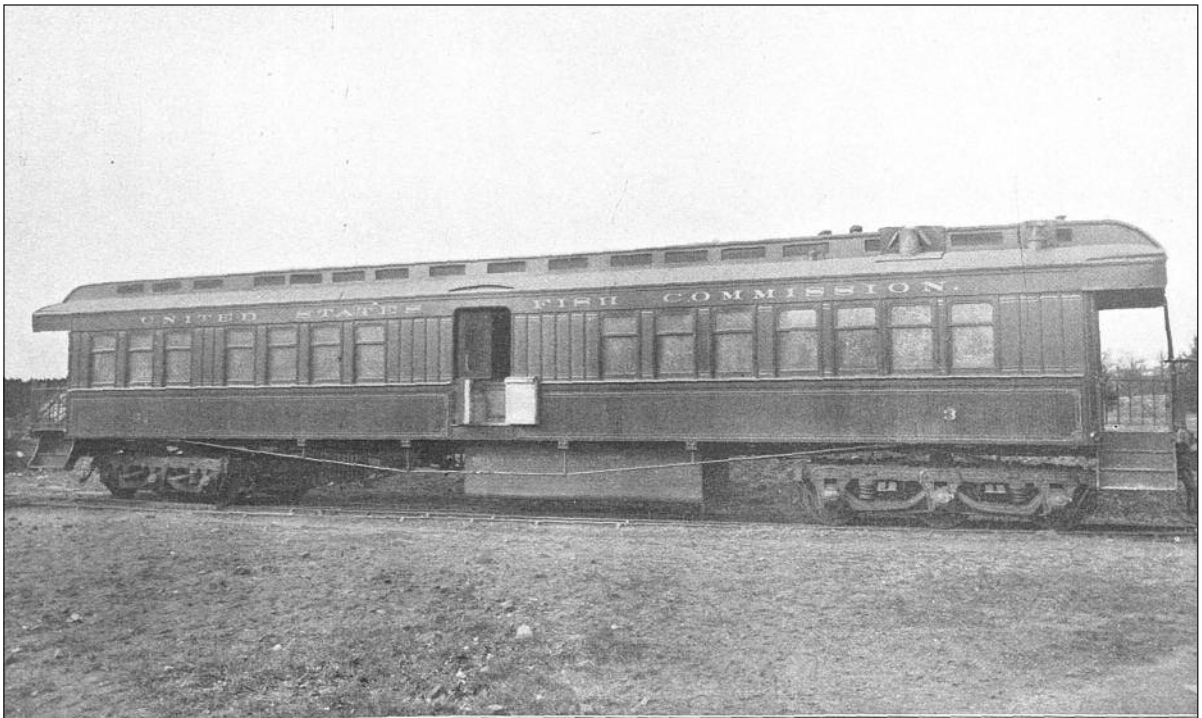
The commission's decision thus made the McCloud station dispensable. Aside from a few shipments to the federal hatchery in Washington, D.C., and the Northville hatchery, only five states received eggs from Stone in 1887. The last shipment of rainbow eggs from the McCloud went out on 6 April 1887, bound for Washington, D.C. Later that month, some 37,000 fry were hatched and released back into the McCloud. Although the salmon station downstream continued to operate for many more years, Stone's trout-taking operation on the McCloud River was now history.[36]

Trout in Missouri

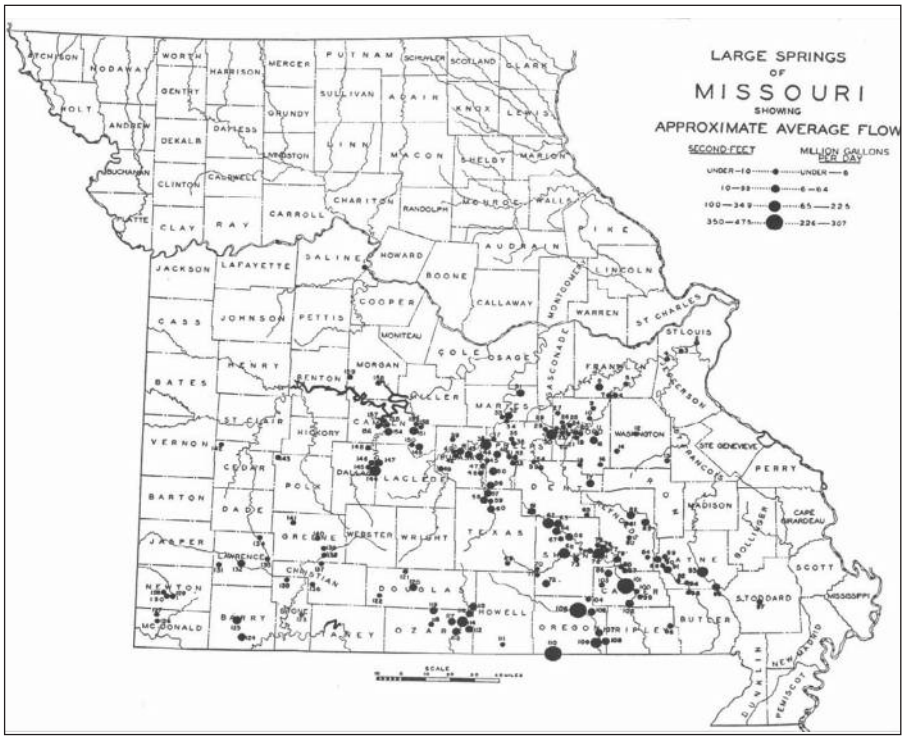
The federal government's trout operation on the McCloud, how it began, functioned, and even ended, set the stage for getting rainbows distributed across the country. In this section I offer a brief look at how rainbow trout (and other trout as well) came to Missouri. Aside from different names of participants and rivers, Missouri's early history with rainbow trout is probably quite similar to that of your state.

Missouri's first fish commissioner was named in 1877, and one of his first priorities was to get Missouri into the salmon sweepstakes. This was accomplished the following year when, as part of the Great Experiment, Pacific salmon were first planted in Missouri.[37] The fish commissioner acted alone, and it soon became apparent that a fully formed commission was necessary. In April 1879 the state legislature, after the usual political squabbling, passed legislation creating a three-man commission. An immediate task for Missouri's fish commission was to coordinate state activities with federal authorities in the salmon stocking program. A pressing issue was the fact that the state did not have a cold-water hatchery. After a statewide search was conducted—although the eventual location was probably known from the start—a site in St. Joseph was announced.[38] Constructed in 1880, the hatchery allowed the state to acquire fertilized eggs (first salmon, then trout), hatch them, and deposit the fry into local rivers.

During the summer of 1879, the three commissioners toured the state to scout out the most suitable locations in which to deposit trout. The tour achieved two purposes. The first was to find the best locales, although several spring-fed rivers were already well known and were probable candidates. The second was to advertise the undertakings of the new commission. How better to drum up public support than to dangle the opportunity for local streams to be stocked with what to many was an "exotic" import?[39]



U.S. Fish Car No. 3. From Report of the United States Commissioner of Fisheries *(Washington, D.C.: U.S. Government Printing Office, 1899), plate IV, facing page 31.*



Large Springs of Missouri, 1944. Courtesy of Missouri Geological Survey.

Because the commission initially focused on where to stock brook trout—the craze over rainbows had yet to strike—they specifically chose summer for their tour. Why? So they could identify those streams in which cold water was abundant even in the hot and dry months. As such, they focused their energies on the south-central and southwestern parts of the state: the Ozark region. The geology of the region created hundreds of cold-water springs. As the map above illustrates, there are quite a few large springs (the larger dots) and many more smaller springs (smaller dots).[40]

Equally important, the "Frisco" rail line ran from St. Louis in the east to the southwest corner of the state. This put two key ingredients to transplanting fish together: spring-fed streams and easy access. Because state and federal fish commissions relied heavily on the railroads to distribute fish, the coincidence of cold-water springs and rail lines heightened the probability that trout releases would be made and succeed in this region of the state.[41]

After identifying suitable rivers—and surely after being lobbied by local sportsmen and civic leaders—the Missouri commission purchased 5,000 one-year-old brook trout, ranging in size from 3 to 4 inches. They were released into several Missouri rivers in late November 1879.[42] I wish I could report exactly where the first release was made, but the official records only reveal that brook trout were stocked into about eight different locations. I say "about eight" because the record oftentimes does not identify a specific river, only listing "tributaries of" some river or just naming the county in which the deposit was made. What is certain is that the commission released the majority of the lot—some 2,000 trout—into Bennett's Great Niangua Spring and stream. Why did Bennett Spring, as it is called today, deserve this honor? Bennett Spring is one of the largest cold-water springs in Missouri, and the commission proclaimed it "the best trout stream found by us in the state."[43]

Missouri's love affair with the rainbow didn't begin until the summer of 1880. It was an inauspicious beginning, garnering a single sentence in the Missouri Fish Commission's first report. After it extolled its stocking and prospects for brook trout, the *Report* noted that "the Commission also distributed in the waters of the State, and mostly in those of the southwest, in July, 1880, 10,000 California [rainbow] trout."[44] This level of enthusiasm was equaled only by commission's announcement that it had German carp in state-owned ponds available for individuals to stock their ponds.

Missouri's trout-stocking program quickly expanded to include rainbows and even other cold-water fish. Over time the state and federal authorities often acted independently. The stocking of rainbows in Missouri was so successful that the U.S. Fish Commission offered it up as an example of what could be accomplished. Marshall McDonald highlighted the success of rainbow deposits in the Missouri Ozarks in the U.S. Fish Commission's 1886 *Bulletin*.[45] His article gives one Missouri river special attention: the Spring River, where 3,000 rainbow fry, all hatched from McCloud eggs, were released in 1880 into its headwaters near the town of Verona.

McDonald's article used a report he received from Dr. H. J. Maynard, who, along with a member of the Missouri Fish Commission, visited the Spring River in October 1885 to classify a trout "said to be found there."[46] Maynard tells of finding a stream teeming with rainbows. "I saw over 100 trout, ranging from 12 to 18 inches in length," writes Maynard. He goes on to report that "about 30 of the larger size were taken. At the head of the river . . . I saw many thousands . . . which were 4 or 5 inches long."[47] For Maynard—and other fish culturists—this discovery meant that "with a little care and expense all streams [in the area] can be made alive with a remarkably fine game fish, which is also an excellent and delicate table fish."[48] Early signs from this new experiment showed that rainbows were going to be a much more successful transplant than brook trout and California salmon.

The early and continued success in the Spring River and other streams quickly made the rainbow the cold-water species of choice in Missouri. The state commission looked "to propagate this game-fish in sufficient numbers to supply such streams as suited to them, *and more especially to encourage private enterprise to engage in fish culture*"[49] [emphasis added]. Planting trout in public waters served the sportsman *and* the average Joe who fished to put food on the table. According to shipping records, it sent trout to many private individuals outside of the Ozark region, often to see if rainbows could be propagated and cultivated as a food source—farmed, as it were. "The encouragement of this form of fish culture [the private raising and stocking of trout] among our agricultural population is the earnest desire of the [Missouri] Fish Commission."[50] And try they did. Given the size of the shipments (often fewer than 100 fish) and their destinations, recipients were not trying to establish wild trout populations, but trying their hand at trout farming.

Stocking trout in Missouri continued in the 1880s, but it became more sporadic. Some years no releases are reported, and in others, like 1886, many streams and rivers were stocked. By the mid-1880s, the focus was on rainbows. (The experiment with salmon in Missouri all but ended in 1883.) This would be the

norm until 1890, at which time the state experimented with releasing brown trout into many of the same streams. There also is a marked change in approaches to stocking in 1886, evident by the fact that the U.S. Fish Commission released about 4,600 rainbows compared with more than 21,000 by the state. Why the difference? Recall that by this time the federal policy was to release larger trout, which meant fewer trout per deposit. The state, however, was still releasing fry.

The years 1886 and 1887 also mark an important shift in fish culture. The fry distributed out of the state's St. Joseph hatchery in 1886 were hatched from eggs originating from the McCloud station in California.[51] The U.S. Commission's stockings, however, originated from its Northville (Michigan) or Wytheville (Virginia) hatcheries, probably from the hatcheries' own brood stock. Remember that by 1887 the trout operation on the McCloud River was closing down, with one of the last shipments of McCloud eggs to Missouri in February going to the St. Joseph hatchery. This means that all future stockings of rainbow trout were propagated from hatchery stock. Rainbows planted in Missouri (and elsewhere) after this date were *descendants* of the McCloud rainbow, but they were no longer true McCloud rainbows.[52]

In the remaining years of the nineteenth century, the Missouri Fish Commission basically ceded the role of planting trout to the federal authorities. This occurred for two reasons. First, propagating trout at the state's only cold-water hatchery in St. Joseph was becoming overly expensive. And carp were crowding out trout in the state hatchery's budget and importance.[53]

The other factor was the construction of a new federal hatchery at Neosho, Missouri.[54] With the U.S. Fish Commission closing down its rainbow facility on the McCloud River and the push toward propagating rainbows in its hatcheries, increasing the number of production facilities was warranted. In October 1888, Neosho beat out competing cities, and after a year of construction the hatchery was up and running.[55] Not only did opening the Neosho hatchery expand the U.S. Fish Commission's ability to supply trout, but it also expanded the kinds of fish it could experiment with. This meant that, as in Missouri for example, over the next decade the local streams were stocked with a buffet of cold-water fish, including rainbows, brook trout, brown trout, grayling, and lake trout. In 1896 there even was an inexplicable release of Pacific salmon, all from the Neosho hatchery.

At the turn of the twentieth century, stocking the state's streams and ponds continued. Starting in the early 1900s, the state commission expanded its cold-water hatchery system. It also developed state-run trout parks around these facilities, giving everyone, for a nominal fee, a chance to put some trout on the table. The state also ran a program of stocking other streams, although on a less-than-daily basis. Some streams, in which stockings ceased many years ago, boast self-sustaining wild trout populations even today. Like other states' experiences, these efforts in Missouri helped to satisfy the public's desire to catch rainbows, "that most noble fish."

Depositing fish out of milk cans into a stream. Courtesy of Lovells Museum of Trout Fishing History, Grayling, Michigan.

Summing Up

Rainbows were distributed wide and far across the country (and world). Those in federal and state commissions were widely praised for their efforts, although success produced mixed blessings. These actions were not without criticism. "Once a race of trout has been thoroughly domesticated by rigorous selection to perform well under hatchery conditions," writes Behnke, "the conclusion is that the genetic changes that have taken place favoring growth and survival under artificial conditions are negative changes in regard to survival under harsh natural conditions."[56] But the Faustian deal had been struck: rainbows would be propagated and stocked, often indiscriminately and by the millions in state after state, including Missouri. If they died shortly thereafter or were fished out—it is not an uncommon sight to see anglers line up as a fish commission's truck empties its hold of trout into the water—the remedy was simple: replace them with a seemingly endless supply of hatchery fish. Cynics would claim that this is not why the science of fish propagation was developed.

Changes have occurred. To satisfy the angling public, demand was met by states like Missouri building their own hatcheries and creating put-and-take trout parks. Departments of conservation and federal fish hatcheries also produce fish for less-trafficked catch-and-release streams managed by state agencies. In the end, whether you prefer the trout park or the experience of catching a wild trout, it is, at least to me, amazing that it all began with the idea to send salmon from Northern California to places like central Missouri. And when that didn't work, the switch to trying rainbow trout proved successful beyond, I am sure, the wildest dreams of anyone 140 years ago.

Endnotes

1. It turns out that there is a large variety of "rainbow" trout. For a good introduction to the topic, and to get an appreciation for the difficulties in classifying trout, see Robert Behnke's monograph *The Native Trouts of the Genus Salmo of Western North America* (Lakewood, Colo.: Regional Forester, 1979). It

may well be that the trout Stone and his colleagues caught and stripped eggs from were not resident or fine-scaled McCloud rainbows (what Stone called red-sided trout) but sea-run steelhead. That is the argument put forth by P. R. Needham and R. J. Behnke in their article "The Origin of Hatchery Rainbow Trout," *Progressive Fish Culturist* (1962, vol. 24, no. 4), 156–58. Behnke argues in "Livingston Stone, J. B. Campbell, and the Origins of Hatchery Rainbow Trout," *The American Fly Fisher* (Fall 1990, vol. 16, no. 3, 20–22) that most of the rainbows used as brood stock in hatcheries back East (or in Argentina or anywhere else) were a mixture of steelhead and fine-scaled rainbows. As he puts it, "there never was a 'pure Shasta rainbow' in fish hatcheries; it was a hybrid from the start" (20). An alternative interpretation is given in Anders Halverson, *An Entirely Synthetic Fish: How Rainbow Trout Beguiled America and Overran the World* (New Haven, Conn.: Yale University Press, 2010).

2. Halverson, *An Entirely Synthetic Fish*, 39.

3. It should be noted that the ongoing experiment to transplant shad from the East to other parts of the country was successful to varying degrees.

4. Among others, see Behnke, *The Native Trouts of the Genus Salmo of Western North America*; Behnke, "Livingston Stone, J. B. Campbell, and the Origins of Hatchery Rainbow Trout"; Halverson, *An Entirely Synthetic Fish*; and the sources cited therein.

5. The location is described in Livingston Stone, "Report on the Operations at the United States Trout Ponds, McCloud River, California, during the Season of 1879," *Report of the Commissioner of Fish and Fisheries* (Washington, D.C.: U.S. Government Printing Office, 1880), 717.

6. Ibid., 695.

7. Ibid., 718.

8. Livingston Stone, "Account of Operations at the McCloud River Fish-Breeding Station of the United States Fish Commission, from 1872 to 1882, Inclusive," *Bulletin of the United States Fish Commission for 1882* (Washington, D.C.: U.S. Government Printing Office, 1883), 232. This account, based on past annual reports, was written at Baird's request for the 1883 International Fisheries Exhibition in London. It was meant to highlight the advances in American fish culture, which had for the past decade caught up to their European counterparts. The advances made in American pisciculture are exemplified by the numerous accolades given to Seth Green, such as the gold medal he received from the Société Impériale Zoologique d'Acclimatation of France in 1875 and the gold medal from the German Fisherman's Club in Berlin awarded in 1880. See Sylvia Black, "Seth Green: Father of Fish Culture," *Rochester History* (July 1944, vol. VI, no. 3), 1–24 for more details.

9. The remainder, some 59,000 eggs, either failed to become fertilized or simply were unusable.

10. There were several shipments of eggs from McCloud to hatcheries in other states in mid-March. Given transportation time and time to hatch the eggs, I am assuming that no other state or individual could have distributed rainbow fry before Maryland's April 15 date.

11. T. B. Ferguson, *Report of T. B. Ferguson, Commissioner of Fisheries of Maryland* (Hagerstown, Md.: Bell & Co., Printers, January 1881), lxiii–lxiv.

12. The location of the society's hatchery seems to be in dispute. Behnke ("Livingston Stone, J. B. Campbell, and the Origins of Hatchery Rainbow Trout") puts it in the basement of a building on the campus of the University of California in Berkeley. Halverson (*An Entirely Synthetic Fish*) locates their first hatchery in San Francisco at the corner of Fulton and Gough, moving the operation to the San Pedro Ranch, about 15 miles outside of San Francisco, in 1871.

13. For more on Green's connection, see R. W. Hafer, "How Rainbow Trout Came to Missouri (and Your State Too), Part I: The Beginnings," *The American Fly Fisher* (Spring 2021, vol. 47, no. 2), 8–15.

14. My source is Behnke, "Livingston Stone, J. B. Campbell, and the Origins of Hatchery Rainbow Trout." Behnke notes that Green made the distinction between these California mountain trout and the trout that came from the McCloud River, the latter which he believed was the first "true" rainbow used in fish culture. The original source for Behnke's claim is based on comments made by Green at the 1880 annual meeting of the American Fish Culturists Association.

15. It also appears that the rainbow did so well that Green's son Chester was sent to California to collect trout fry from the McCloud River, undoubtedly a river already known to Green given his relationship with Stone. Chester Green returned to New York with 113 rainbow trout fry in May 1878. Cited in Halverson, *An Entirely Synthetic Fish*, 35.

16. J. B. Campbell, "Notes on McCloud River, California, and Some of Its Fishes, Based on a Letter of J. B. Campbell, of the United States Fish Commission," *Bulletin of the United States Fish Commission for 1881* (Washington, D.C.: U.S. Government Printing Office, 1882), 44–46.

17. J. H. Wales, "General Report of Investigations on the McCloud River Drainage in 1938," *California Fish and Game* (1939, vol. 25, no. 4), 272–309. Behnke ("Livingston Stone, J. B. Campbell, and the Origins of Hatchery Rainbow Trout") suggests that the 1874 date is too early, 1875 being when the Bay Area trout were shipped east and thus the first time rainbows were introduced outside of their native range.

18. How Campbell came to know Seth Green back in New York State is unknown to me. In his letter, Campbell informs Baird that he had been corresponding with Green "for over two years," suggesting that "if you want to know more how the McCloud trout thrive in New York you can apply to him [Green], as I have supplied him with all that he has got from that river." J. B. Campbell, "Notes on McCloud River, California, and Some of Its Fishes," 45.

19. The distinction is "outside" of its native range. There are numerous reports of fish culturists in California experimenting with propagating rainbow trout. In the "Fish Culture" section of the 21 September 1876 edition of *Forest and Stream*, there is a reprint of an article originally appearing in the San Francisco publication *Pacific Life* reporting the success of several individuals who were propagating rainbow trout and stocking them in nearby lakes.

20. See Behnke, "Livingston Stone, J. B. Campbell, and the Origins of Hatchery Rainbow Trout."

21. Seth Green, "Rearing of California Mountain Trout (*Salmo Irideus*)," *Bulletin of the United States Fish Commission for 1881* (Washington, D.C.: U.S. Government Printing Office, 1882), 23.

22. Ibid.

23. Livingston Stone, "An Account of Operations at the McCloud River Fish-Breeding Station of the United States Fish Commission, from 1872 to 1882, Inclusive," *Bulletin of the United States Fish Commission for 1882* (Washington, D.C.: U.S. Government Printing Office, 1883), 233.

24. Baird was always seeking to increase his budget, and he did so quite successfully. By 1879, the appropriation for the U.S. Fish Commission increased fivefold, from an initial $15,000 to $70,000 (in current dollars, from about $345,000 to a bit more than $1,772,000; this approximate price equivalency uses data from Robert J. Gordon and Stanley G. Harris, "The Annual Consumer Price Index for the United States, 1774 to Present," MeasuringWorth.com, www.measuringworth.com/datasets/uscpi/, accessed 28 October 2020). Most of the annual budget—between 75 and 85 percent—was spent on fish propagation and stocking programs. See Halverson, *An Entirely Synthetic Fish*, 39.

25. Wakeman Holberton, "The Successful Stocking of Streams with Trout," *Bulletin of the United States Fish Commission for 1882* (Washington, D.C.: U.S. Government Printing Office, 1883), 192.

26. Roland Redmond, "On Rainbow Trout Reared from Eggs Brought from California," *Bulletin of the United States Fish Commission for 1882* (Washington, D.C.: U.S. Government Printing Office, 1883), 230.

27. S. B. Smith, "Efforts to Raise Trout," *Bulletin of the United States Fish Commission for 1885* (Washington, D.C.: U.S. Government Printing Office, 1885), 435–36.

28. The wild success of the commission's carp program also gave credence to that idea, much to the commission's and others' later chagrin.

29. Cited in Chas. W. Smiley, "Notes Upon Fish and Fisheries," *Bulletin of the United States Fish Commission for 1885* (Washington, D.C.: U.S. Government Printing Office, 1885), 104.

30. Marshall McDonald, "Report on Distribution of Fish and Eggs by the U.S. Fish Commission for the Season of 1885–86," *Bulletin of the United States Fish Commission for 1886* (Washington, D.C.: U.S. Government Printing Office, 1886), 385–94.

31. McDonald played an important role in the evolution of the Fish Commission's approach to stocking rainbow. His belief that federal hatcheries like the ones at Northville (Michigan) and Wytheville (Virginia) should be the suppliers of trout was based on his

"engineering" approach to fish culture: rainbows could be propagated and stocked just like any other domesticated animal. It should also be noted that he was responsible, as a member of the Virginia Fish Commission, for choosing the site of Wytheville as one of the few federal hatcheries in the country. For more on McDonald's background and life, see Marshall McDonald, www.seafareproject.eu/marshall-mcdonald/. Accessed 17 April 2019.

32. McDonald, "Report on Distribution of Fish and Eggs by the U.S. Fish Commission for the Season of 1885–86," 387–88.

33. Ibid., 388.

34. Fish cars or aquarium cars were either retrofitted train cars or cars designed specifically to haul fish. The primary mode was to place fry or larger fish into containers—originally dairy milk cans—and move them about the country, letting those receiving the shipment take them to their final location. Sometimes fish were deposited in rivers near railroad bridges. This led to deposit sites listed in, for example, Missouri's records simply as "along Frisco railroad." Both the federal and state commissions used such methods to transport fish. For a detailed treatment of the fish car and the so-called fish era, see, among others, William D. Middleton, George Smerk, and Roberta L. Diehl, eds., *Encyclopedia of North American Railroads* (Bloomington: Indiana University Press, 2007).

35. McDonald, "Report on Distribution of Fish and Eggs by the U.S. Fish Commission for the Season of 1885–86," 388.

36. McDonald was playing a much larger role in commission decisions by this time. Given his background (see note 31), it is not far-fetched to argue that the change in the commission's approach to stocking trout emanated from the top. Spencer Baird died in August 1887 and McDonald took his place, officially becoming the U.S. fish commissioner with President Grover Cleveland's appointment in January 1888. The date of McDonald's appointment and the shuttering of the McCloud trout station probably are not mere coincidence. Nor, as I discussed in Part II, was McDonald's treatment of Stone. For more, see Halverson, *An Entirely Synthetic Fish*, 46–47.

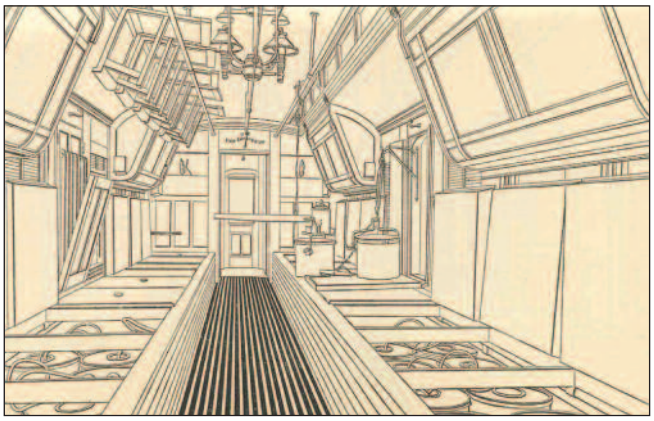
37. I provide more detail about this in Part II of this series. See R. W. Hafer, "How Rainbow Trout Came to Missouri (and Your State Too), Part II: The Great Experiment," *The American Fly Fisher* (Summer 2021, vol. 47, no. 3), 2–11.

38. To say that politics played an important role is an understatement. For more, see Chapter 4, "Salmon in Missouri," in Rik W. Hafer, *From Northern California to the Ozarks of Missouri: How Rainbow Trout Came to the Show-Me State* (2020), 69–86.

39. Trout fishing was not unknown to Missourians. One can find many newspaper accounts of trout-fishing trips back east and out west in the years before the stocking program. Consequently, when the chance arose to have such angling closer to home, the public was very receptive to the idea. As I have mentioned, trout were often touted as an additional source of protein to be cultivated like any other livestock.

40. The abundance of cold-water springs in the southern half of the state, noted in Part II of this series, also explains why most salmon releases were made in those counties. For a detailed discussion of Missouri's springs, see Jerry D. Vineyard and Gerald L. Feder, *Springs of Missouri* (Columbia: Missouri Department of Natural Resources, 1982).

41. The symbiotic relationship between railroads and fish commissions is easy to see. In Missouri's stocking records, it is common to find entries that list the location of a trout deposit with nothing more than "along Frisco tracks." Railroads also were thanked profusely in biennial reports of the Missouri Fish Commission for their (often free) assistance. By this time, fry and later larger trout were being transported in standard 10-gallon milk cans, carried either in luggage cars on private railroads or in fish cars (see note 34). For a discussion of the early history of Missouri's fish car, see Chapter 3, "Egg Crates, Milk Cans, and Fish Cars," in Hafer, *From Northern California to the Ozarks of Missouri*, 45–68.



Interior view of car showing arrangement of cans of fish. From Report of the Commissioner [of Fish and Fisheries] for 1882 *(Washington, D.C.: U.S. Government Printing Office, 1884), plate IV.*

42. The records are not clear from whom they were bought.

43. *Report of the Fish Commission of the State of Missouri to the Thirty-Second General Assembly for the Years 1879–80* (Jefferson City, Mo.: Tribune Printing Company, State Printers and Binders, 1881), 15. Bennett Spring was already a popular fishing destination. The state purchased the property in the 1920s and built a trout hatchery. Today it is the home of one of the state's most popular trout parks.

44. Ibid.

45. Marshall McDonald, "California Trout for the Ozark Mountain Region," *Bulletin of the United States Fish Commission for 1886* (Washington, D.C.: U.S. Government Printing Office, 1887), 447–48.

46. Dr. H. J. Maynard, "Rainbow Trout in Southwestern Missouri," *Bulletin of the United States Fish Commission for 1887* (Washington, D.C.: U.S. Government Printing Office, 1889), 55–56.

47. Ibid., 56.

48. Ibid.

49. *Report for 1879–80*, 35.

50. Ibid. This objective would be a persistent theme of the commission. Chair of the Missouri Fish Commission John T. Crisp stated in 1893 to a reporter for the *St. Louis Post-Dispatch*, "We desire for every farmer who has springs on his farm to save his water and make artificial lakes. . . . Why not save up our spring water and raise fish just the same as we do hogs, cattle, sheep or any other animal? . . . I expect to live to see the day when fish markets will be done away with." Quoted in "Fish Commission: One of the Members Talks about Its Work Meeting Tomorrow," *St. Louis Post-Dispatch* (28 July 1893), 3.

51. The McCloud shipping records show that in February and again in April of 1886, a shipment of 45,000 eggs went to St. Joseph.

52. The wild rainbows in Crane Creek, located in southwest Missouri, often are declared to be the last vestiges of true McCloud rainbow. It was one of the original streams to be stocked, and the trout there today are genetically distinct from other wild trout in the state. But the "McCloudness" of these fish has long since been diluted with years of stocking hatchery-raised rainbows. It makes a good story, but the resident wild trout are only distant relatives of the original McCloud rainbows.

53. The chair of the Missouri Fish Commission, I. G. W. Steedman, explained it thus: "The apparatus and ponds at the St. Joseph hatchery were originally constructed and intended only for the propagation of cold water fish, such as trout and salmon; but for the last two years, through scarcity of money, we have been compelled to abandon entirely the propagation of these fish, as the process of hatching and distribution is far more expensive than in the case of carp." I. G. W. Steedman, *Carp and Carp Culture in Missouri*, 2nd ed. (St. Louis: Nixon-Jones Printing Company, 1884), 98.

54. The hatchery remains in operation to this day.

55. The Neosho National Fish Hatchery is the oldest federal fish hatchery in operation. Among other species, it currently propagates rainbow trout, pallid sturgeon, endangered Topeka shiners, and endangered Ozark cavefish. More about the history of the hatchery can be found in Elizabeth Ann Wilson, "The Oldest United States Fish Hatchery," in *Neosho: A City of Springs* (Neosho, Mo.: Newton County Historical Society, 1984) 56–58, or visit the U.S. Fish & Wildlife Service website at https://fws.gov/midwest/neosho/.

56. Behnke, *The Native Trouts of the Genus Salmo of Western North America*, 114. Halverson levels a more damning assessment in *An Entirely Synthetic Fish* (46).