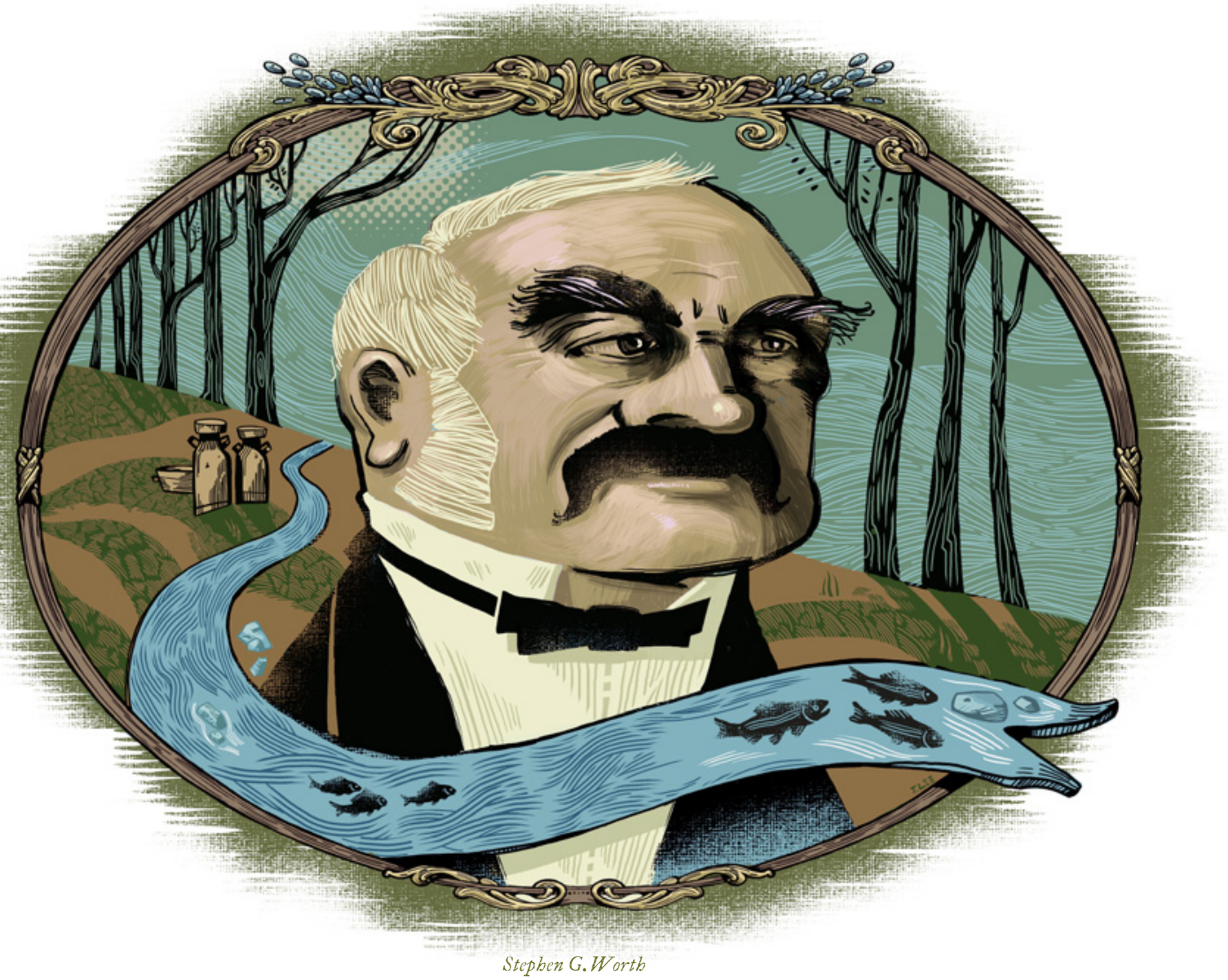


Stephen G. Worth

PART ONE OF A THREE-PART SERIES

CHEAPER TO BUY BACON

In attempting to provide food for the people, North Carolina's first fish commission plunged wholeheartedly into artificial propagation, with decidedly mixed results.

WRITTEN BY JIM WILSON ILLUSTRATED BY TIM LEE

"In general, there are no public expenditures that will insure more certain and more immediate returns than those devoted to intelligent and systematic fish-culture."

— Hugh M. Smith,
"The Fishes of North Carolina," 1907

For a fleeting slip of time in the 19th century, two elegant, exotic species of fish glided through mountain rivers of North Carolina, flashing their silver forms in the currents. They were as different from other fish in these waters as reason is from passion. But their time here would be brief, their destiny doomed from the start by biology, geography and the best scientific thinking of the day.

North Carolina would prove no proper home for Chinook salmon, of the northern Pacific Ocean, and Atlantic salmon, native to the northern Atlantic regions, despite their enthusiastic welcome from the state's first fish commission, which released about 800,000 of them into waters public and private. Within several years, the state discontinued stocking these fish, having seen few results but not yet realizing that while cold western rivers might be hospitable for salmon, the long, broad stretches of sluggish, warm waters between mountains and ocean formed a deadly avenue these anadromous species could not negotiate.

Salmon, however, did survive long enough to be caught in North Carolina. Reports exist of 16-inch Chinook being landed "with the fly" in the French Broad River near Asheville, of landlocked Atlantic salmon in the Catawba River and Mill Creek in McDowell County, and landlocked salmon and rainbow trout, another California introduction, taken in fish traps in the Johns River. The salmon left no physical evidence of their presence; they simply ceased to exist, forgotten and unchronicled except in the pages of government reports more than a century old, where their story is a testament to how a 19th-century government agency attempted to remedy a fisheries dilemma by ameliorating the symptoms after realizing it was all but powerless to resolve the causes of the problem.

"At the present time no fewer than 2,000 nets of different kinds are in operation between the mouth of the Neuse River and Goldsboro, N.C.," Yarrow wrote, warning that "if this industry is continued we must expect, in a short time, the same deplorable scarcity of shad here as in the rivers farther south."

North Carolina's early fish commission was short-lived, functioning only eight years, from 1877 to 1885, but some of its work continues to affect the state. Although the bulk of its efforts focused on stocking American shad (*Alosa sapidissima*), a species then economically important to much of the Coastal Plain, the commission's lasting efforts involved the stocking of two exotic species: common carp (*Cyprinus carpio*) and rainbow trout (*Oncorhynchus mykiss*).

The fish commission was born in turbulent times, beginning operations just as Reconstruction ended in the South and occupying Federal troops headed home. Too, the Depression of 1873-1879 had slowed the economy not only of North Carolina, but the nation. The price of cotton, for example, fell about 50 percent between 1872 and '77. This depression was part of the "Long Depression" that affected Europe and the United States for the last quarter of the 19th century.

Although modern Americans tend to think of the 19th century as a period of bountiful natural resources, declines among animals such as white-tailed deer and turkeys and a number of fish species already were considered acute in some areas. By the late 18th century, American bison already had been extirpated in North Carolina, by 1880 the Eastern elk was extinct in North America, and the passenger pigeon and Carolina parakeet would follow early in the 20th century. N.C. State University professor Larry Nielsen has written that given the aggressiveness with which Europeans approached North America, "local resource depletion and environmental problems" developed rapidly. "Pastures were overgrazed, forests were overharvested, streams were overburdened with wastes, and fisheries were overexploited."

It was neither mammals nor birds that moved governments to act in the second half of the 19th century; it was fish. As early as 1864, George Perkins Marsh, considered this country's first environmentalist, had written of the decline of fish in "Man and Nature": "[A]lmost all the processes of agriculture, and of mechanical and chemical industry, are fatally destructive to aquatic animals within reach of their influence," Marsh wrote. "Milldams impede their migrations, if they do not absolutely prevent them, the sawdust from lumber mills clogs their gills, and the thousand deleterious mineral substances, discharged into rivers from metallurgical, chemical and manufacturing establishments, poison them by shoals."

The depletion of the inshore commercial fisheries of New England was so dire that Congress in 1871 had created the U.S. Commission of Fish and Fisheries, with Spencer Baird, head of the Smithsonian Institution, as that agency's director. (In the 20th century, that commission would become the U.S. Fish and Wildlife Service.) In 1873 Baird sent U.S. Army surgeon H.C. Yarrow to report on the status of American shad in Southern rivers. "At the present time no fewer than 2,000 nets of different kinds are in operation between the mouth of the Neuse River and Goldsboro, N.C.," Yarrow wrote, warning that "if this industry is continued we must expect, in a short time, the same deplorable scarcity of shad here as in the rivers farther south."

Yarrow found the situation on the Roanoke River also grim. John Embry, "proprietor of the Embry House, mayor of the city, and controller of all the fisheries on this part of the Roanoke River," was so efficiently catching shad with a fish slide—a device constructed of lumber and wooden screens across part of the river—that Yarrow predicted that unless this method of fishing changed, "shad will have disappeared almost entirely from these waters in a few years hence." (Embry also joked to Yarrow that should the U.S. Fish Commission desire to begin propagating striped bass, he could provide a train carload of eggs in a matter of two weeks.)

It was this diminution of food fish populations that prompted the formation of North Carolina's first fish commission, as it had in 25 other states over the 13 years since New Hampshire had formed the nation's first commission. Thus, the General Assembly created the state department of agriculture in 1877, with prominent agrarian leader, politician and journalist Leonidas Lafayette Polk as its director. The legislation also charged the agriculture department "with the supervision of all measures for the protection, propagation and culture of fish in the rivers and other inland waters of this state, and to this end they shall at once provide for stocking all available waters of the state with the most approved breeds of fishes."

That an agricultural agency should oversee the state's initial forays into fish culture is not as incongruous as it might seem. Although the majority of today's fishermen are recreational anglers, until the 20th century, fishing was pursued primarily for sustenance or income. In carrying out its charge from the general assembly, North Carolina's new fisheries agency would take the pragmatic approach that fish are a crop to be harvested. That remains the function of modern commercial aquaculture: the production of food fish for market or, in the case of some species, for stocking in private ponds.

The idea of animals as a crop also would become an early tenet of the science of wildlife management, receiving 20th-century validation in Aldo Leopold's 1933 "Game Management" when the conservation icon wrote: "Game management is the art of making land produce sustained annual crops of wild game for recreational use. … Its nature is best understood by comparing it with the other land-cropping arts."

Polk and Stephen G. Worth, superintendent of the North Carolina commission, believed there were two major problems to overcome in North Carolina: the many dams on our streams and the multitude of nets in the water, particularly in the Coastal Plain. The dams prevented anadromous fish species from ascending into the interior of the state, thus depriving those citizens of food fish. The nets effectively did the same thing: The catch in the east prevented fish from reaching the interior.

"Shad and sturgeon formerly ascended the Catawba and Yadkin to their head waters," Worth wrote. "By man's agency they have been cut off, and the result is sadly felt." He decried the "alarmingly apparent" decline as being "an outgrowth of our civilization and results first from cutting them off from their favorite spawning grounds with dams, and second by increased fishing to supply the wants of a growing population. … A general law requiring all owners of dams to build a sluice-way over each, after a pattern prescribed by your board is our only hope. … The dams stand as barriers and destroyers and if the remedy is not applied our annual supply will necessarily be on the diminishing scale."

Worth ostensibly had the backing of the general assembly in his pleas for a solution to the problems brought by dams. In the department of agriculture's establishment bill, the general assembly had instructed the department to "report upon the practicability of constructing fish-ways over dams and other obstructions … and secure, as far as practicable, the co-operation of mill owners."

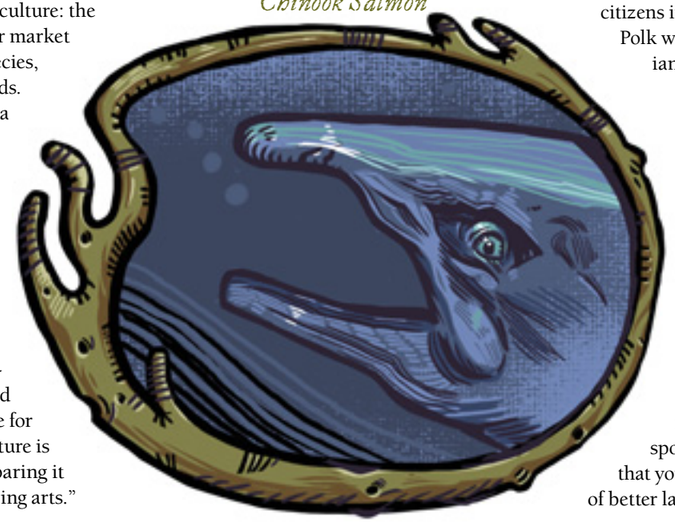
Polk, however, realized that a solution to the problem of the dams, "erected from bank to bank by private parties," would be a thorny matter. "While it is repugnant to the spirit of our people, as well as to our organic law, to invade the rights of the citizen, yet it is equally repugnant to grant a citizen exclusive privileges and emoluments," Polk wrote. The question he posed was this: "Has a citizen, living, for example on the Roanoke, the Cape Fear, or Pee Dee River, the right to erect dams or other obstructions in that stream, that he may appropriate the products and profits of such stream to his own use, thereby excluding the thousands of citizens further in the interior and contiguous to such stream from its benefits?"

The answer for Polk was clear. "We must have a free passage for the fish of our streams, and especially in our rivers," he wrote. "Were this effected by the enactment and enforcement of proper laws, we might hope at no very distant day to see our streams, by natural reproduction, restored to their original productiveness. I would therefore, earnestly suggest that the attention of the General Assembly be directed to the importance of enacting an efficient general law, to apply to all our principal waters, for securing the free passage of fish."

A man ahead of his time, Polk also called upon the general assembly to address the "wanton and reckless destruction of birds and other game in the State." Having had "extensive correspondence with intelligent citizens in different portions of the State," Polk was convinced that North Carolinians would support a "law to prevent the indiscriminate slaughter which so seriously threatens extermination to many of our most valuable species of game.

"Vast numbers of even insectiverous and other harmless birds (and which are good friends of the farmer) are annually destroyed. The partridge, turkey and deer especially are eagerly destroyed without regard to value or season, for mere sport, and I earnestly recommend that your Board ask for the enactment of better laws to protect our game."

Chinook Salmon



However, Polk would not long remain as head of the agriculture department, an agency he helped create with Gov. Zebulon Vance. After a new governing board was put in place for the department following the election of Vance to the U.S. Senate, Polk resigned his post in 1880. He went on to found *Progressive Farmer* magazine, helped establish N.C. State University, Meredith College and the N.C. Museum of Natural Sciences and became a national figure in the populist movement. He likely would have received the People's Party nomination for president in 1892, but died shortly before the convention.

It became apparent to Worth by 1881 that "practicable" solutions the legislature spoke of would not be found quickly, if at all. "With the destructive agencies removed they [fish] would soon be plentiful, but agencies are being multiplied," he wrote of the dams. He also realized that stopping overfishing was going to be impossible. "To arrest the fishing for a term of years would add greatly to the increase which would take place naturally, but this would throw into disuse thousands of dollars worth of nets and boats and would be as absurd as it is impossible," he wrote.

Although the legislature did pass numerous statutes providing for fish passage and restricting harvest, enforcement was minimal at best, a situation that extended well into the 20th century for both fish and wildlife laws. Consider the plight of Frank Coxe, owner of a plantation in Polk and Rutherford counties between the Green and Broad rivers. In seeking "a million or two" American shad from the federal fish commission in 1884, Coxe tells of how finally the shad were returning far upstream after the Cherokee Dam some miles down river had finally washed out after 40 years of existence. One concern remained, Coxe wrote: "The only problem this season in protecting the fish has been with the dynamite cartridge. We have a ganger here for a small distillery a few miles below, who has been throwing these cartridges in the river, which destroyed every fish, large and small, in 50 feet around; and when he was told he would be indicted, said he would like to see the State officer that could arrest him, and the trouble is that three-fourths of the people believe what he says."

North Carolina had a general law in place by 1879 making it a misdemeanor to take fish with dynamite cartridges, punishable by a fine of not less than $5 nor more than $25 upon conviction. Fishing with dynamite continued to be a problem in some areas of the state for many decades.

As for dams and other artificial obstructions, as far back as 1787 the state had mandated that any owner of an obstruction on a river, such as a dam, must provide passage for fish or pay a penalty of 5 pounds per 24 hours that the river was blocked. The legislature continued passing other such laws, specific to individual waterways, throughout the next century, but accomplished little. It would be 1927—50 years after Polk's plea for protection of wildlife—before North Carolina passed a comprehensive state law establishing game and fish seasons, along with bag and creel limits.

The question remained as to how North Carolina could bring food fish to residents of the interior of the state, where, as Worth wrote: "The migratory fishes no longer appear. . . . Citizens of these counties now depend upon the purchase of fish brought by rail, or else follow the more usual rule and go without. . . . We desire to make fish cheaper for the people—cheap, as a food supply. It is only in favored localities in the more eastern belt of our State that the poorer classes of our citizens can afford to buy fish. Outside this territory, the price is such that it is cheaper to buy bacon."

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What was left for the state was the relatively new and popular science of the artificial propagation of fish. "Propagation by the artificial method is an outgrowth of necessity," Worth wrote. Stocking fish would be the solution for everything—the dams, the overfishing, the pollution and the lack of enforceable laws. Not only would citizens of the state have plenty of fish to eat, but also there would be an abundance of fish to take to market.

North Carolina's policy would mimic that of the federal fish commission, which was expressed best in 1884 by George Brown Goode, who briefly held the job as commissioner of the agency after Baird's death: "[I]t is better to expend a small amount of public money in making fish so abundant that they can be caught without restriction, and serve as cheap food for the people at large, rather than to expend a much larger amount in preventing the people from catching the few that still remain after generations of improvidence."

The possibilities, in terms of food and commerce, seemed limitless. In apprising the legislators of the actions of the fish commission, Worth stressed that the state could earn sizable sums of money at little expense. "Few realize the value of fish," he wrote, "but a moment of reflection will show that they cost us nothing, and that by replacing them in the waters by aiding their imperfect efforts we restore to our land at a nominal cost its millions of wealth that our streams annually bear away to the ocean. Who knows the value of the constituents of our gliding rivers, and by what means can we reclaim it? By the judicious expenditure of a few thousand dollars annually we can attain it."

Noting that our state has the "finest shad fishing grounds in the world," Worth wrote that by stocking "our sounds ands rivers to ten times their present capacity, we can supply every demand at home and bring into our State thousands of dollars from abroad. As the truck-farms of the south are annually reducing the value of like products on those further north, in supplying the ready demand for early vegetables and fruits, so will the fisheries of the Albemarle Sound and other waters, in like manner reap large cash sums of money from northern markets if the millions of eggs now annually wasted on the seine beaches, are only hatched and cared for."

Worth noted, too, that artificial propagation was much more efficient than nature. "On examination of the nests of the California Salmon it is found that only *eight* per cent of the eggs are impregnated," he wrote in 1880. "By the artificial method of impregnation we secure *ninety* to *ninety-five* percent!"

Americans' interest in stocking fish was nothing new, and dates back to Thomas Jefferson and Benjamin Franklin. However, it was not until 1853 when plastic surgeon Dr. Theodatus Garlick first successfully

propagated fish in this country by growing brook trout on a farm near Cleveland. Artificial propagation had been practiced in Europe since 1843, but in the United States, it was still the latest thing. The novelty of fish culture was so compelling that in some northern states, people were hatching out brook trout in their living rooms as hobbies.

Even the authors of a book that extolled the pleasures of fishing the North Carolina mountains for brook trout could not help but espouse the possibilities of fish culture. In "Heart of the Alleghanies [sic] or Western North Carolina," published in 1883, Warren G. Zeigler and Ben S. Grosscup comment: "A fortune could be made in fish culture in the Carolina mountains. The valley of Jamestown, six miles east of Cashier's valley, is admirably suited for an enterprise of this kind. A lake of six square miles could be formed here by damming, at a narrow gorge, a fork of Toxaway [River]."

Although the idea of artificially propagating fish was captivating, the reality in North Carolina was daunting for one critical reason: Not a man in the state knew anything about fish culture. That proved no impediment to immediate action. The state's first effort at collecting shad eggs in April 1877, only days after the agency was formed, proved but minimally successful, despite the presence of experienced fish culturist Frank Clark of Michigan, sent by the U.S. fish commission to assist. Polk explained the lack of success simply: "Prevailing freshets and diminutive run of shad interfered with full success of the work."

For the one-year period ending April 1, 1879, Worth reported that the fish commission had released "over three and one-half millions of young shad, three hundred thousand California Salmon, fifteen thousand and five hundred Land-locked Salmon from Maine, and fifty thousand Mountain or Brook Trout."

Within a scant two years, however, the state's fish culture work, led by Worth, one of the workers in the state's first attempt at collecting shad eggs, had stocked millions of fish. Polk, writing in 1879, noted that the results belied the state's lack of preparation to begin culturing fish. "Commencing only two years ago without a shad box, distributing can, or the least preparation of the necessary apparatus used in fish culture, or without a man in the State who knew the principles of the work, the people of the State may congratulate themselves on what has been attained."

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"This art is so new that very few among us have had an opportunity of looking into it sufficiently to know its requirements or to pass judgment on past operations," Worth wrote, further stating that all of the stocking had been accomplished for under $3,000, including "a sum not less than five hundred dollars in permanent structure and hatching and distributing apparatus, tools, etc., now on hand, including all salaries. This sum when compared with results will bear favorable comparison with similar work done any where on the globe."

In the beginning, Worth predicted those "California Salmon" could be the backbone of the state's stocking operation. The state received eggs from the federal commission and hatched them out at facilities in Swannanoa and Morganton, eventually planting 748,000 Chinook. "To convey an idea of the immense returns in fish culture, I will make a statement which may surprise you," Worth wrote. "California Salmon attain an average weight of 20 pounds, and will sell readily at twenty-five cents a pound. If we suppose that ninety-nine per cent of the three hundred thousand hatched this season are never heard from again and that the one percent which do return attain the average weight of other waters and bring a price of five cents a pound, the salmon of the past season alone will more than pay the expenses of the whole season, including the Shad, Land-locked Salmon and Trout. … Why it shall not live here I cannot see."

Those dreams of piscine plenty came to naught. Writing in his 1907 "The Fishes of North Carolina," ichthyologist Hugh Smith concluded that although the planting of Chinook salmon (*Oncorhynchus tshawytscha*) and Atlantic salmon (*Salmo salar*) might have been justifiable "in view of the lack of knowledge of the requirements of those fishes … they are now known to have been entirely useless expenditures of time and money."

In fact, the Chinook were a failure everywhere they were introduced. Anders Halverson relates in "An Entirely Synthetic Fish" that despite 45 million Chinook eggs having been shipped across the country, primarily to Eastern and Southern states by 1879, "Not a single new run of these fish had been established."

The eggs were captured and fertilized at the McCloud River hatchery in California and transported to 29 states. More than a decade after the federal commission ended its attempts to stock Chinook east of the Mississippi River, Livingston Stone, who had built the hatchery and directed its operations, spoke of the failure as a "stupendous surprise and disappointment." "The eggs hatched out beautifully," Stone said. "The young fry, when deposited in the fresh-water streams seemed to thrive equally well. They grew rapidly and when the proper time came were observed to go down in vast numbers to the sea. What afterwards became of them will probably remain forever an unfathomable mystery."

The state stocked many fewer Atlantic salmon than Chinook, only about 15,000. According to Smith, the stocking of Atlantic salmon was particularly impractical. "As the natural habitat of this salmon includes no streams south of New York, the waters of North Carolina were manifestly unsuited for the species and the attempt was almost necessarily a failure."

However, Smith, who would later lead the federal fish commission, believed the landlocked Atlantic salmon, which trout biologist Robert Behnke describes as an environmental rather than genetic subspecies of Atlantic salmon, could have survived in North Carolina. He suggested that the waters where those fish were stocked in 1878 and 1881—the Dan, Linville, Mayo and Johns rivers and creeks in McDowell and Burke counties—were not the most suitable.

"No results from these plants were ever noted," wrote Smith, who thought Lake Toxaway in Transylvania County would have proven a better location. At the time of Smith's writing, the U.S. Bureau of Fisheries had sent about 30,000 landlocked salmon eggs for hatching to Toxaway, but the original lake, built in 1902, vanished in 1916 when its earthen dam broke. The lake was rebuilt in the 1960s, minus the salmon.

Of the six species stocked by the state fish commission during its history, only two, American shad and brook trout (*Salvelinus fontinalis*), were native to North Carolina, and the agency stocked brook trout but once, in 1879 when 36,000 were planted. (Some fish in this stocking were an attempt to restore brook trout populations to streams that no longer held them, such as those near Glen Alpine Springs in Burke County.)

The agency attempted to propagate striped bass, but with little success. Worth, at the behest of the federal commission, did, however, establish in 1884 a hatchery at Weldon on the Roanoke River, a site that would be used by the federal commission and later the N.C. Wildlife Resources Commission to grow and release millions of striped bass. In addition to Chinook and landlocked salmon, the other exotic species planted by the agency were common carp and rainbow trout, each of which would have a lasting impact on the state, but by very dissimilar means. ◆

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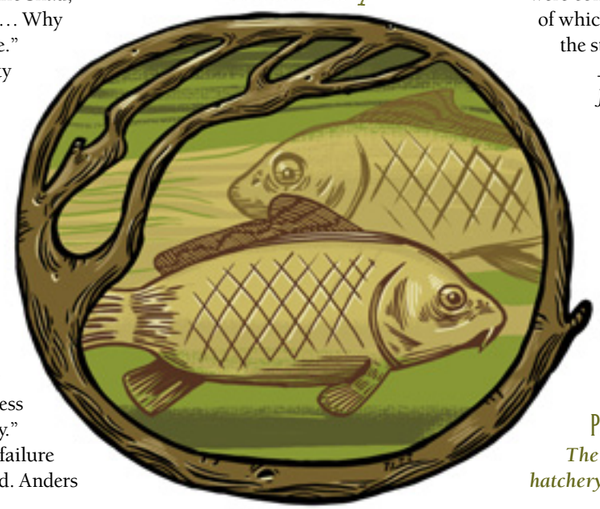
Common Carp



Part Two: May 2011

Common carp and rainbow trout find permanent homes in North Carolina

Part Three: June 2011

The rise of modern, consistent hatchery operations throughout the state