The Rainbow Trout in the North Platte Valley

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THE RAINBOW TROUT
IN THE NORTH PLATTE VALLEY
LAKE McCONAUGHY is the only Great Plains reservoir that supports a self-sustaining rainbow trout population. This unique rainbow population lives during the spring, summer and fall in Lake McConaughy and spawns during the winter in tributary streams of the North Platte River in the Scottsbluff area.

Fishing for large rainbow trout in the tributary streams began in the late 1940's. Trolling for trout in Lake McConaughy, however, did not become popular until the late 1950's and early 1960's. With this popularity came a significant increase in fishing pressure not only in the lake but also on the spawning streams. The Game and Parks Commission was concerned because not enough information was available to properly manage the rainbow trout population under increased fishing pressure. During the mid-1960's a study was initiated to collect information and prepare a rainbow trout management plan for the upper North Platte River drainage. This publication is part of that endeavor.

The Lake McConaughy rainbow begins its life in the gravel riffle areas of groundwater streams in the upper North Platte Valley. The female rainbow fans a depression in the shallow gravel areas of the stream. She then deposits eggs, and they are quickly fertilized by male rainbows. The female covers the eggs with four to eight inches of gravel and then abandons the nest. The spawning nests or redds, visible because of the disturbed gravel, can be seen throughout the winter in the spawning streams. Rainbow trout
Lake McConaughy trout begin their life in gravel riffles of North Platte feeder streams. Three years later they return to perpetuate their kind spawning is probably confined to the tributary streams of the North Platte River. Spawning has not been documented in the main channels of the river.

Large gravel areas in swift-flowing streams are among the most important requirements for successful reproduction of rainbow trout. Gravel and rocks of one to four inches in diameter provide the spawning habitat in Nebraska. During the spawning season, stream water must be clear; otherwise sand or silt will drift over or settle on the gravel, smothering the eggs that are deposited in the gravel riffle areas. The North Platte Valley contains more streams capable of supporting natural reproduction of trout than all the rest of Nebraska streams combined.

It takes approximately 8 to 10 weeks for the rainbow eggs to hatch and for the fry to develop. After the fry have absorbed their yolk sacs they emerge from the gravel and start feeding on tiny invertebrates drifting in the water. Rainbow fry can be observed during the February to May period in shallow, quiet, slow-moving areas of the stream. By June these fry have reached two to three inches in length and are strong enough to remain in swifter water, where they are hard to observe unless feeding on insects at the surface. The small trout grow during the summer, fall and winter in their native streams. By early spring, one year after being hatched, the juvenile rainbow have reached a length of 7 to 10 inches. Most of them are then ready for the long journey out of the spawning streams, down the North Platte River and into Lake McConaughy. During the 1965 to 1974 period, 91 percent of the juvenile rainbows moved to the lake at the age of one year, while 9 percent remained in the spawning streams two years before migrating to the lake. The juvenile rainbows that spent two years in the spawning streams probably represent the younger and slower growing members of the population. Virtually all the rainbows in the North Platte Valley streams migrate to Lake McConaughy.

The appearance of the juvenile rainbow changes drastically just prior to the downstream migration to Lake McConaughy. The parr marks (dark, oval markings on the side) characteristic of fingerling-size rainbow, disappear while the sides of the trout turn from light gray to a bright, silvery white. The tips of the tail and to a lesser extent the tip of the dorsal fin (large fin on the back) turn nearly black and the entire body becomes more streamlined. This change in appearance is described as the "smolt stage" and the juvenile rainbows moving to the reservoir are called "smolts." The 7 to 10-inch rainbows with their black tails are obvious and can be spotted by quietly walking along the spawning streams in late February, March and into April just prior to downstream migration.

The smolts enter Lake McConaughy during March, April and May. Some years during May the small trout or smolts can be observed breaking the surface of Lake McConaughy in the Sport Service Bay area, located directly south of the dam. Upon entering Lake McConaughy, the rainbow feed upon plankton, consisting mainly of cladocera or water fleas. The water fleas in the adult stage are only .1-
The North Platte Valley streams have the potential to produce more trout naturally than all the other streams in the state combined.

inch in size and are most abundant during spring and early summer. The rainbows grow rapidly, and by July when the gizzard shad spawn, are 12 to 13 inches in length. At this size the rainbows change from a plankton diet to one of small fish, usually gizzard shad. At the end of the first summer or growing season in Lake McConaughy, the rainbows have grown to an average length of 15 inches. A small percentage of them, mostly males, will mature at this size and migrate upstream to spawn. However, a majority of the Lake McConaughy rainbows become sexually mature one year later, at three years of age. At that time they migrate out of the lake because they cannot successfully spawn in standing water.

Two distinct spawning runs occur from Lake McConaughy. The largest occurs during the fall, with rainbows starting to leave the lake in September and continuing until late November. The peak usually occurs between the last week in October and the middle of November, depending somewhat upon weather. Abrupt, adverse weather conditions temporarily reduce the number of rainbow migrating from the lake, but a sharp rise in the barometer usually triggers an increase in the number leaving. Rainbow prefer to migrate upstream during the night. The second largest run of rainbow is during the spring. This migration occurs about the time of ice break-up in the lake (March 1 to April 1). Undoubtedly some rainbow trout move during the December-February period, but these could not be monitored at the electrical weir and fish trap located on the North Platte River near Lewellen. This facility was instrumental in collecting most of the North Platte rainbow trout life history data.

Annual spawning runs during the 1965 to 1974 period were composed of 5% two-year, 70% three-year, 23% four-year, and 2% five-year-old rainbow. There is a high natural mortality of spawners between the first and second year. During the 1965 to 1974 study, 77% of the rainbow spawned only once, 21% twice, and only 2% spawned for a third time. This spawning mortality seems high but is actually lower than reported for rainbow populations in other states. The spawning runs contain approximately two females for every male, which is normal for rainbow populations. The average size of rainbow trout spawners is 20.6 inches with an average weight of 3.9 pounds.

When the trout complete their journey up the North Platte River and enter the groundwater streams to spawn, their life cycle is nearly completed. And, they end in the same streams where they were hatched three years before. They have moved the 100-mile length of the North Platte River twice, been exposed to high water temperatures, flooding, irrigation return waters, and predation by both man and other fish in the streams, river and lake. The few that have returned are expected to perpetuate the species, which can if the proper spawning habitat is available and the waters remain clean and pollution free.

Rainbow trout captured in the Lewellen trap were tagged from 1967 to 1972. Anglers returned 19 percent of the tags, indicating that anglers catch a minimum of 19 percent of the population. Data also indicate that of the rainbows caught, 73 percent were taken by stream fishermen and 27 percent by lake fishermen.

The importance of the spawning streams is shown by the return of tags by anglers. Approximately 42% of rainbows caught in spawning streams came from Nine Mile Creek.

Most of the trout spawn in the streams where they were hatched. A small percent, however, “stray” to other streams. There appears to be less straying and more of a homing instinct in the fall-run fish than the spring run. This straying is most noticeable in Pumkkin Creek. Although very few trout successfully reproduce in Pumpkin Creek because of poor spawning conditions and high summer water temperatures, each year, especially during early spring, large rainbows migrate up Pumpkin Creek several miles to a small irrigation dam. All of these are strays which were hatched in other streams in the drainage. Rainbow straying also occurs in Lake McConaughy. During the spring, as soon as the ice breaks up, a small percentage of the total trout population in Lake McConaughy can be observed in the Sport Service Bay area and similar rocky shores in the southeast corner of the lake. These fish apparently do not have a strong migration instinct to leave the lake even though they can never successfully spawn there. Especially in the last 10 years, most of the rainbow in the lake have hatched or originated from spawning streams in the upper North Platte Valley. Because the trout which stay in the lake never spawn successfully, fewer are seen each year. This fact, rather than a smaller number of rainbow in the lake as suggested by some anglers, probably explains why fewer numbers of rainbow have been observed the past few years along the rocks during early spring.

The Lewellen trap made it possible for the first time to collect information from large numbers of rainbow trout during their spawning runs. One example is the occurrence of deformed trout in the population. Examination of 5,184 rainbow during 1967 to 1975 shows 241 (4.6 percent) were abnormal or deformed. Occasionally, anglers report catching a deformed rainbow. It is usually a natural occurrence, and is rare because deformed fish are usually too weak to survive in a natural population. Deformities are much more common in hatcheries where there is less competition. Anglers also have reported trout with red, infected spots. The same thing was observed on rainbow examined at the Lewellen trap. The infected areas are caused by a parasite identified as an “anchor worm”. This condition is most noticeable during the August-November period, and is caused by a small parasite attached to the side or fins of the fish. It does not cause the trout to be unfit for the table, but does detract from its normal appearance.

In any self-sustaining rainbow population, the most competitive and
successful individuals survive to carry on the population. Rainbow trout were originally spring spawners. In the case of the Lake McConaughy rainbow, however, a more successful fall run has become established because the stream environment in the North Platte River drainage gives it an advantage over a spring run. Fall spawners have an advantage because the young have from February until May to grow enough to survive the critical conditions that exist during summer months. Also, during this period they become acclimated to warming water temperatures. In contrast, the spring-run rainbow barely emerge from the gravel when the streams begin to show the effects of the critical summer season (floods, irrigation return water and high water temperatures). Because of these factors, the bulk of the rainbow trout production in the spawning streams, especially Nine Mile Creek, occurs from the fall run. This is the reason the prime spawning areas in Nine Mile Creek are closed from October 1 through December 31. Although spawning can be observed periodically from November through April, the most active period and best hatching success occurs before January 1. Stream studies conducted by the Game and Parks Commission in Nine Mile Creek during the months of January and February indicated that approximately 72 percent of the rainbow trout had already spawned by that time.
CHANGES IN rainbow trout management were made during the first years of the rainbow trout investigations. Hatchery origin rainbow stockings in the North Platte Valley spawning streams were ended after 1967. This change came because hatchery trout were not increasing the number of 3 to 4-pound rainbow returning to the streams to spawn. Beginning in 1962, all hatchery rainbow trout were marked prior to stocking in spawning streams. Only a few were caught by fishermen, and even fewer survived to a large enough size to spawn. They did not survive because they could not adjust to the adverse environment that exists in the spawning streams during the critical summer months and they didn’t have the instinct to migrate into Lake McConaughy. In addition, these 6 to 9-inch trout were competing with the 1 to 2-inch natural-reproduction trout that were present in the spawning streams during the spring. During 1967 the emphasis was shifted from hatchery trout to stocking fingerling trout hatched from Lake McConaughy rainbow trout eggs. The McConaughy rainbow were genetically better adapted to the North Platte River drainage and when stocked, survived better, migrated to the reservoir, and returned as adults to spawn. Because of their superior performance, a stocking program was initiated for all the trout streams in the North Platte River drainage that did not support natural reproduction of rainbow trout. This program was started in 1968.

Land surrounding approximately
Some streams in the North Platte Valley do not produce trout naturally and are stocked annually by Game and Parks Commission biologists (left). Fencing to exclude livestock significantly improves trout habitat. Below, the headwaters of Otter Creek are shown in 1969, before fencing, and then three years later.

Fishery investigations in Red Willow Creek indicated that a substantial number of juvenile and adult rainbow were lost down an irrigation canal on their annual downstream migration to the lake. To prevent this loss a rotary screen was designed and installed in 1975. This screen stopped the loss, and it will be operated during downstream migration periods when water is being diverted.

One of the most significant accomplishments of the rainbow investigations in the North Platte Valley occurred in Otter Creek, a stream flowing directly into Lake McConaughy. The trout population since the mid 1950's had been nearly nonexistent in this stream, and spawning habitat was in very poor condition. Livestock in the upper end of the creek kept the stream banks barren of vegetation. Bank erosion was extreme and the stream became wider. Hard rains in the headwaters would wash sand from the surrounding hills into the stream. Very few pools or resting areas existed in the upper reaches of

1 1/2 miles on the upper end of Nine Mile Creek was purchased by the Game and Parks Commission in 1969. Since that time this area has been managed as a wildlife area with emphasis on good stream management.

The misuse of dip nets by some anglers in the spawning streams caused a change regarding their use. Since 1974, anglers have been prohibited from using landing nets in tributary streams of the North Platte River located in Keith, Garden, Morrill, Scotts Bluff and Sioux counties.
A decade ago, four North Platte Valley streams were producing rainbows. As a result of wise management, eight new streams were added.
Rotary screens, like the one on Red Willow Creek (far left) are used to prevent trout from diverting into irrigation canals. To provide native fish for stocking, biologists collect eggs, (top left) and milt (middle left) from mature female and male trout during their spawning runs. The eggs and milt are mixed and fertilization takes place. After five minutes the fertile eggs are placed in screen-bottomed boxes and washed with clean, cool water in large tanks (bottom left and below). They are immediately transported to a hatchery and then the fry are reared until stocked.

A strain of rainbow trout in Otter Creek changed from nearly zero before 1969 to a high of 20,000, 7 to 10-inch rainbow smolts in 1974. These 20,000, which migrated into Lake McConaughy, make a major contribution to the rainbow trout fishing in the lake.

A decade ago, only four North Platte Valley streams were producing rainbow trout for Lake McConaughy: Nine Mile Creek, Wildhorse Creek, Tub Springs and Dry Spottedtail Creek. Today, as the result of wise management, eight additional streams are productive trout waters. Natural reproduction now occurs in Red Willow and Otter creeks, and the stocking of fingerlings has added Clear Creek, Alliance Drain, Lonergan Creek, Winters Creek, Mitchell Drain and Stuckenhole Creek.

This type of program can be carried out in other streams if cooperation and money are available. The Otter Creek project represents the ideal approach to the management of the rainbow trout fishery in the North Platte River drainage.
**RAINFOREST: PLANNING THE FUTURE**

The North Platte River from Lake McConaughy upstream to the Nebraska-Wyoming line contains approximately 60 miles of coldwater streams capable of supporting rainbow trout. Natural reproduction takes place in about half of these streams. Spawning gravel is not present in large enough quantities to support natural trout reproduction in the other 30 miles of streams. Because of the difference in stream habitat, a management plan was necessary for both stream types.

**Nursery Streams**

The 30 miles of streams which do not support trout reproduction were labeled nursery streams because of their growth potential for trout. Nursery streams contain coldwater habitat that will support rainbow trout once past the critical in-gravel stage. These streams are usually less than eight feet wide and are located in the upper end of the drainages where flooding and irrigation return water is less frequent than in lower stretches.

Many nursery streams stocked with Lake McConaughy rainbow progeny have proven to be excellent production areas. In the nursery streams, McConaughy fingerlings grow to smolt size (7 to 10 inches) in approximately one year, and then migrate to McConaughy. The smolts migrate from the nursery streams in early spring, leaving these streams practically barren of fish. These same streams later that spring are then re-stocked with rainbow fingerlings. This is an ideal situation because the newly stocked rainbow have little competition from other fishes.

The objective of the rainbow trout management plan for nursery streams is to collect 200,000 Lake McConaughy rainbow trout eggs yearly. Each female produces approximately 3,300 eggs, so about 60 females will be required to produce the required number of eggs. The 200,000 eggs are necessary to raise 150,000 fingerlings to a 1 to 2-inch size. If the Lewellen trap is operated, it will be only for a short period (less than two weeks) until enough rainbow are collected to supply eggs for the program.

The 150,000 fingerlings will be stocked in the nursery streams. Stocking rates should be approximately 5,000 per acre of water. Survival in the nursery streams from stocking until the downstream smolt migration one year later usually ranges between 15 and 30 percent. This means that 150,000 fingerlings stocked in the nursery streams will result in Lake McConaughy receiving between 22,500 and 45,000 rainbow smolts each spring in addition to all the 7 to 10-inch natural reproduction trout that also migrate to the reservoir. If, however, the nursery streams are stocked too heavy, the survival and growth rates will be low and fewer rainbow will migrate into the lake.

This fingerling stocking program benefits both the lake and stream angler. Once the smolts migrate into Lake McConaughy they are available to lake fishermen for nearly two years. These same rainbow are then available to stream fishermen during their spawning journey. Even by the time these rainbow have returned, they have served their purpose. Many have been caught, and the ones that haven't may move to other streams to spawn. Nursery stream stocking is superior to both a lake stocking or a catchable (7 to 10-inch) rainbow stocking plan in the spawning streams. Lake stocking benefits only lake fishermen. Stream "catchable" stocking would help only the stream fisherman, if it did that. Besides, catchable stocking, whether in the lake or in streams, is very costly, and under the present hatchery system, facilities are not available to raise the number of trout needed.

**Natural Reproduction Streams**

The 30 miles of streams which support rainbow trout reproduction involve a different management approach. The main objective in these streams is to preserve and enhance...
the trout spawning by providing the best stream habitat possible.

One of the most effective ways to meet this goal is to remove livestock from bank areas. If extreme flooding and fluctuating water levels continue to exist, however, then benefits of livestock removal are diminished. Under normal conditions, however, if grazing can be removed, trout production can be easily increased 50 percent.

The principles used to restore Otter Creek apply equally in the rest of the North Platte Valley streams. Heavily grazed stream banks are continually being trampled and eroded. This accelerated bank erosion causes streams to widen. The wider the stream the less the water velocity. Water velocity is very important to trout, especially in Nebraska. High water velocities help keep the gravel riffle areas washed clean of silt. The gravel riffles are not only important as spawning areas but also provide most of the trout’s food. Slow water also warms up much faster. This is an important consideration because water temperatures in most Nebraska trout streams during the summer months are near the maximum that rainbow can tolerate. Prolonged water temperatures above 75°F is fatal for them, and every effort should therefore be made to keep stream temperatures below 75°F.

The important diversity between pool and riffle areas is sometimes lost with reduced stream velocities. Flooding can cause the same problem. Stream bottom and water depth in many Nebraska streams remain nearly the same, offering little diversity.

Overhanging stream-bank vegetation, besides stabilizing the banks, provides protection and hiding areas for trout. The quality of a trout stream in many instances can be judged by the appearance of its banks.

Landowners interested in improving streams on their property, whether in the North Platte Valley or in any other part of the state, should contact the nearest Game and Parks Commission office or employee. Technical assistance and, in many instances financial assistance, can be given to protect one of Nebraska’s finest natural resources—its streams.

Tub Springs (top) has some portions which are poor “trout stream”. There is little streamside vegetation to provide hiding and resting places for trout. Conversely, Nine Mile Creek (lower photo) has excellent habitat in the portions managed by the Game Commission, with good vegetation narrowing the stream and increasing velocity.
A VERY IMPORTANT part of the North Platte rainbow trout studies was to understand what water conditions the rainbow trout population was subjected to in Lake McConaughy during the summer months. Much was learned about the annual temperature and oxygen cycle.

From ice break-up in the spring until early June, the water temperature and oxygen content from the surface to the bottom of the lake remains the same because of slow warming and the mixing action of the wind. The calm, hot days of early summer cause the surface water to warm faster than that in the middle or bottom of the lake. Since water density changes with temperature, the cooler waters in the depths of the lake form a thermocline, consisting of water considerably cooler than at the surface. The thermocline prevents surface water from mixing with that at the lake bottom. As summer progresses, oxygen in the water below the thermocline is slowly used up by decaying organic materials. This water is cold enough for trout, however, by mid August or sooner, not enough oxygen is available to support fish life. While this is happening below the thermocline, the waters between the thermocline and surface are warmed and mixed by wind as summer progresses.

By mid August, the coolest water remains only in the area of the thermocline, right above the water devoid of oxygen, and below the warm surface waters. Theoretically, the trout also are “sandwiched” in this small area. If “trout water” is defined as water 70°F or cooler, yet containing at least 3 parts per million oxygen, then during August the volume of water meeting this criteria is very small. In some years “trout water”
June
Kingsley Dam
Lemoyne
Otter Creek

July
Kingsley Dam
Lemoyne
Otter Creek

August
Kingsley Dam
Lemoyne
Otter Creek

September
Kingsley Dam
Lemoyne
Otter Creek

Desirable Trout Water
Water with Low Oxygen Levels
Water over 70°

Good trout habitat is cool water, below 70°, and high oxygen levels, over 3 parts per million. As summer progresses, the lake surface warms and decaying organic material near the bottom depletes oxygen. Trout are sandwiched between. By August, good trout habitat includes only a wedge of water 3 to 20 feet deep and from 3 to 8 miles up lake

may be only 3 feet deep and extend up the lake 3 to 4 miles. Other years it may be 15 to 20 feet deep and extend 6 or 8 miles up the lake. The “trout water”, like the thermocline, varies with wind and weather conditions. The most critical period for rainbow trout is usually during the last three weeks in August.

During September, the surface waters begin to cool and the thermocline sinks lower in the lake. During early October, the surface waters have cooled to about the same temperature as water near the bottom of the lake. When this happens, the density of the surface waters and bottom waters are nearly equal and the entire lake begins to mix. This period is called the “fall turnover.” The lake continues to cool and be mixed by winds until freeze-up in December or January.

Two factors will influence the amount of coldwater habitat in Lake McConaughy. The natural aging or eutrophication of the lake is influenced by the activities of man. The lake will reach a point where the organic materials and heavy loads of nutrients, through complicated cycles, eliminate the coldwater habitat. It is anybody’s guess when this will happen. The second factor that will influence the capability of Lake McConaughy to support rainbow trout is also controlled by man—the water level of the reservoir. If the demand for water dictates extremely low lake water levels, then the rainbow population will expire accordingly. As in the case of eutrophication, at what water level the rainbow will disappear is hard to determine. However, the smaller the lake, the warmer the water will get during the critical summer period.

If the waters in Lake McConaughy become too warm and the oxygen too low to support trout, some of the rainbow may attempt to leave the lake via the outlet structures. Unless water quality conditions change drastically, a massive, spectacular summer kill of rainbow may not occur. Rather, the rainbow population will slowly decrease in numbers as the coldwater habitat diminishes.
Experience and knowledge of the trout’s habits and habitat are characteristics marking the successful rainbow fisherman.
BETWEEN THE STREAM fishermen and lake anglers, the North Platte Valley rainbow trout population provides year-around fishing. Although fishing pressure is heavy, it is probably the stream and lake habitats rather than the angler that determines the size of the rainbow population.

Experience and knowledge of the waters favors the good trout angler. For instance, in the lake during the summer, down-riggers or similar devices that control precisely the trolling depth are very beneficial. Flatfish, Thinfin's and large spinners are popular trolling lures. In later summer and fall, rainbow can be taken on the surface by locating schools of shad on calm days. Bank fishing for rainbow is best early in the spring along the dam and rocky areas. June, July and September are the months fishermen report the most Master Angler rainbow (verified catches over 5 pounds) in Lake McConaughy.

Most anglers troll for trout, using lead-core line, diving planes or down-riggers to get lures down into trout water. Depth depends upon time of year, temperature and other factors, but much of the summer it is deep—often 40 to over 60 feet.

It may be a matter of trial and error, working until one is landed and then concentrating on that water depth. At any rate, locating the trout seems to be the major problem of the reservoir angler.

Stream fishermen, however, have a different problem. They can be certain that fish are present in the water they are fishing, as they can usually see them when they cross shallow or clear stretches of water. The problem in this situation is getting fish to hit. Rainbow spawners seldom feed while in spawning streams, as they apparently have other things on their mind. Yet, a good number of them are caught, and many fishermen believe it is a matter of irritating the trout until they strike in frustration.

The most popular bait used is rainbow eggs. These are placed in a piece of nylon or cheesecloth and formed into about one-half-inch balls. A "ball of eggs" is placed on a hook and fished in large holes, either moving it along with a flyrod or letting it bounce along with the current. A gob of worms is the next best bait, with spinners bringing up a very weak third.

Stream fishermen have the best luck when rainbow first enter the spawning streams, consequently November and March are the top months. The precise time rainbow move into each stream varies by season. Here again, experience favors the good angler.

The North Platte River above Lake McConaughy offers rainbow fishing that has not been utilized by many anglers. Float-trip fishing or fishing the deep holes is difficult but productive.

Nearly all the streams in the North Platte Valley are privately owned, and the sportsman respects the law and obtains permission before fishing. Quality rainbow fishing will continue only as long as the trout habitat remains. Sportsmen, irrigation interests and landowners must find an acceptable area of compromise in the North Platte River system or the rainbow will perish because of adverse environments. Help Nebraska trout streams—speak out for clean waters and good stream habitat.
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