The Decline and Fall of Big Spring

By Ken Undercoffer

Recently, I received an e-mail from Dr. Jack Black, the author of an article “What Happened to Big Spring?” in the February 1999 edition of Fly Fisherman. We exchanged a few e-mails about brook trout and he offered me the in-depth report upon which the article was based.

The report was the result of the accumulated efforts of a group of dedicated people who recognized that there was a problem at Big Spring and set out to find out what happened and why. It is an example of the effectiveness of grass-roots activism and shows how much a few determined individuals, operating on a limited budget, can accomplish.

Dr. Black authored numerous reports dealing with the effects of toxic chemical pollution upon Great Lakes fish while working as a senior scientist at the Roswell Park Cancer Institute. He is now retired and lives in Williamsville, NY. He grew up near Hershey and fished Big Spring Creek almost exclusively until he left the area in 1955. In his own words: "I never lost track of Big Spring, and Big Spring as it was in those days haunts me to this day."

The idea of a project to investigate what happened to Big Spring Creek took root in the ‘70s during streamside discussions between Jack Black, Vince Marinaro and Charlie Fox. Later, Fox sent Black a list with the names of several individuals who were knowledgeable about Big Spring. Some years later, during a trip to Big Spring, Black decided that it was time to act and contacted the individuals on the list that Charlie Fox had given him. One of the most enthusiastic was the late Garrett Mortenson who invited Black to present his ideas at a luncheon, in August of ‘95. Gene Macri, a biologist with expertise on benthic invertebrate life, was also invited and a partnership was formed.

They began a detailed study of Big Spring Creek. Macri did the detailed benthic work. Ralph Shires, an environmental chemist, conducted much of the water chemistry work, including gravel interstitial-water dissolved oxygen studies. Garrett Mortenson and, after Garrett’s death, Jack Hunter helped in acquiring memos and unpublished reports from the Pennsylvania Fish and Boat Commission files.

A Big Spring Brookie Photo Tim Bennett

What follows is a brief summary of the report: An Ecological Survey of Big Spring Creek with Emphasis on the Effects of Fish Hatchery Effluent by Gene Macri, MS and John J. Black, Ph.D.

Big Spring Creek originates from a large spring south of the town of Newville. It flows north about 5 miles before emptying into Conodoquinet Creek. Until the mid-‘50s, it was the last remaining major limestone stream in Pennsylvania to hold a population made up almost entirely of brook trout. And what a brook trout stream it was. Charlie Fox compiled excerpts from old sporting journals dating back to 1829. They told of daily catches of hundreds of brook trout. Theodore Gordon fished Big Spring just after the turn of the 20th-century and wrote: "In June I have seen the water covered with the dimples of rising trout as far as my view extended."

Big Spring brookies were noted for their propensity to feed on the surface. The stream "was an absolute mayfly factory years ago" according to Macri. It teemed with mayflies, caddis, stoneflies, fishflies, dragonflies and clouds of diptera. Sulfurs were abundant and hatched regularly from May to July. And for the larger brookies, those bigger than about 11 inches, there were abundant sculpins. This exceptionally rich forage base enabled Big Spring brook trout to once reach weights in excess of 4 pounds. English outdoor writers in the ‘20s, 30s and ‘40s felt it was comparable to the finest English chalk streams

Brown and rainbow trout were repeatedly stocked in Big Spring Creek, but were never able to replace the brookies. Most of the hatchery fish were caught out within a few weeks after stocking. A few browns did manage to survive long enough to reach incredible sizes, including several state records of 15 to 17 pounds. And no wonder … they had an unlimited supply of brookies on which to feed! But until the end, Big Spring Creek remained, for the most part, a brook trout stream.

In 1953 the Green Spring Trout Company built a hatchery about one-half mile below the source of Big Spring Creek. By 1957 the hatchery was producing 300,000 to 400,000 trout. By 1958, the native brook trout population below the hatchery had collapsed. The Green Spring Hatchery was only in existence for fifteen years. After its closure in 1968, brook trout in the downstream section enjoyed a slight resurgence. Through all of this, however, the brookies above the hatchery continued to thrive. A population density of 1708, one- to six-year old brook trout per acre was reported by Dr. Edwin Cooper and Dr. Robert Scherer in a 1967 study of the upstream section. Many ranged from 12 to 15 inches in length.

In 1971 Pennsylvania Fish and Boat Commission biologist Robert Hesser reported "an unbelievable number of young of the year brook trout fingerlings" in the upper end of Big Spring Creek. These were probably the last remnants of the original Big Spring Creek brook trout gene pool.

In 1973 the Pennsylvania Fish and Boat Commission [PFBC] opened the Big Spring Fish Cultural Station at the source of Big Spring Creek. The hatchery uses 8,000 gallons/minute [gpm] of water. This is a large proportion of the total flow of the spring which ranges from 6,000 to 15,000 gpm and averages 12,500 gpm. Almost immediately a precipitous decline in the number of brook trout in the stream was noticed. This was confirmed in a 1977 electrofishing survey by the PFBC. The only part of the stream containing substantial numbers of trout was the "ditch," a channelized section starting just below the outflow of the hatchery and extending 150 yards downstream. Numerous brown, rainbow and palomino trout were captured in this

section, indicating that most of the trout were hatchery escapees. And that is the way it is to this day. Only 30 trout per acre inhabit the section from the lower end of the "ditch" to the old Green Spring Hatchery dam and from there on down, only 10 per acre.

I fished Big Spring Creek once, several years ago, and caught nothing below the "ditch," but did manage to catch several brookies and browns in the "ditch." I could not understand the dearth of trout below the "ditch." Although rather shallow, it was covered on both sides with cress and looked like it should have held a lot of trout. The reason it does not is now apparent. The careful work done by the ad hoc group formed by Black and Macri tells the tale.

Water quality studies were conducted to determine how much the nutrient load of Big Spring was being increased by the hatchery effluent. Samples were drawn from above and below the hatchery. Nitrites and phosphates were raised by well over 200%, total phosphorous by 550% and suspended solid wastes by 450%.

Excessive nutrients increase the biochemical oxygen demand [BOD] in streams. Healthy natural waters typically have a BOD of 5 ppm or less. BOD levels of 11.1 ppm and 7.9 ppm were measured at the hatchery outflow and just below the "ditch," respectively, during March and April of 1996.

As would be expected, dissolved oxygen [DO] levels in Big Spring Creek were being adversely affected by the increased nutrient flow from the hatchery. During late summer after extended cloudy periods, high temperatures and low water flows, near-dawn oxygen levels reach their lowest levels in streams. And not only trout are affected … many mayfly species are especially sensitive to low dissolved oxygen levels. Continuous exposure to DO levels below 5.0 ppm causes reduced growth and survival of trout. In late summer, Big Spring DO levels were measured at points just below the "ditch" and 1.5 miles below the hatchery. Levels as low as 4.5 and 5.5 ppm were observed.

High dissolved oxygen levels are especially important to the viability of brook trout eggs deposited within the gravel of redds. Trout will migrate for miles in order to find suitable areas for spawning. They instinctively understand the necessity of depositing their eggs where the water is clean and well aerated. Both eggs and fry are extremely sensitive to low oxygen levels and any sort of pollution. Sampling tubes were inserted into Big Spring redds and interstitial-water oxygen levels within the gravel determined.

Even though dissolved oxygen concentrations in the stream remained high (as one might expect during cold winter months) dissolved oxygen levels within the sampled redds fell gradually to 4.2 and 4.6 ppm. Levels of 5 ppm and lower cause complete redd failure. And just as troubling, as the sampling tubes were being inserted into the redds, a strong odor of rotten

eggs was detected coming from the gravel. This odor is indicative of hydrogen sulfide, a highly toxic gas formed under anaerobic conditions. Fish eggs are extremely sensitive to its effects.