



Waterville Lake has been both good and bad for the Pigeon River. Walters Dam, which impounds the reservoir, altered the river's flow significantly, but for decades the lake has filtered out pollutants from the paper mill upstream by acting as a settling pond.

NCWRC

## Pigeon River Revival

The Pigeon River was once so polluted that North Carolina classified the best use of its waters to be for waste disposal. Beginning in 1908, industrial discharge from a paper mill in Canton—just 6½ miles from the river's origin in Haywood County—turned the Pigeon the color of coffee and devastated many species living in its darkened waters. Toxic chemicals such as dioxins, furan and chloroform flowed downstream through the Pigeon River Gorge and into Tennessee. In 1930, its filthy waters were impounded by the Walters Dam for

hydroelectric power generation, altering habitat and river flow patterns. The Pigeon was, for all practical purposes, biologically dead.

Studies by the N.C. Wildlife Resources Commission, the N.C. Division of Water Quality and others documented the decline in the river's biodiversity, including the extirpation of all native snails and mussels. The Tennessee Valley Authority noted that the fish community downstream of Canton was dominated by pollution-tolerant species such as gizzard shad, common carp and goldfish. In 1988 and 1989, after finding high levels of dioxins in fish, the states of North Carolina and Tennessee issued "do not consume" advisories on all fish in the Pigeon River below the paper mill.

As early as 1911, citizens' groups in eastern Tennessee had waged grassroots campaigns asking North Carolina to address the unabated pollution flowing from Canton. Eventually, the state of Tennessee sued the state of North Carolina to force a solution. The federal Environmental Protection Agency intervened in the early 1980s and gave the paper mill a timetable and a clear set of rules for cleaning up its discharge. The mill took action to comply with its newly mandated wastewater standards. More quickly than anyone expected, the river began to look cleaner. The color of the Pigeon improved from "coffee" to "weak tea," and the level of carcinogenic dioxins in fish dropped low enough that authorities rescinded most of the fish consumption advisories. In the late 1990s, conservation agencies began to wonder if they might be able to restore native species to the river. Because many surviving populations were isolated in other French Broad tributaries with no way to return to the Pigeon River, scientists knew that not all native aquatic species could return without assistance. That meant reintroducing species to the river.



JODY DUGGINS

Once considered little more than a sewage ditch, the Pigeon River is on the rebound. Improved water quality has encouraged biologists to reintroduce native aquatic species.

written by Joyce A. Coombs

Right: Flooding from September hurricanes damaged populations and habitats of fish, and left debris high and dry on Clyde bridges. Below: Researchers snorkel the lower Pigeon, searching for reintroduced fish.



JODY DUGGINS



JOYCE COOMBS

Wildlife in North Carolina has followed the Pigeon River story over the years. For a look at early efforts to clean up the river, see "The Plight of the Pigeon," Feb. 1981. Later cleanup work and the potential of the Pigeon as a recreational resource was covered in "New Hope for the Pigeon," March 1992. For information about dam relicensing and the benefits for wildlife written into new agreements, see "Generating Changes," Feb. 2004.

Past articles about the Pigeon River ended with hopeful statements that the river might be cleaned up within a decade. With native species living and reproducing in the river again, perhaps the rebirth of the Pigeon as a clean, thriving river is finally close at hand.

a Wildlife Commission fisheries biologist working on the Pigeon River Recovery Project, said that in addition to the paper mill's effluent, nonpoint source pollution is a problem on the upper Pigeon above Waterville Lake. Municipal wastewater, other urban pollution and runoff carrying sediment from poorly managed construction, forestry and agriculture projects create a significant cumulative effect on the Pigeon River that

The scientists chose snails to begin with, because the survival of snails would indicate whether other aquatic species such as mussels and fish might also live there. Snails reintroduced in 1996 made it, leading to additional snail reintroductions in 1999 and the transplanting of nine species of common mussels in 2000.

The Pigeon River, which had decades earlier been read its last rites, began to thrive with new life. Once scientists proved that the Pigeon could again support invertebrate

life, excitement began to build. State, federal, university and industrial groups joined the effort to revive the river, and the Pigeon River Recovery Project was born in 2001.

### What species go where?

Before the snails and other wildlife came back home, researchers had to do a tremendous amount of digging into the faunal history of the river. Because the Pigeon had been a cesspool for so long, no one knew what native species were supposed to be there. Fish experts from the N.C. Museum of Natural Sciences, N.C. Wildlife Resources Commission, University of Tennessee and other groups located historical records of river fauna from surveys dating back as far as 1877. Using detective work, educated guesses and inventories of species that live in Pigeon tributaries, the groups compiled a list of species they believed were native to the Pigeon River. They estimated that 40 species of native mussels and 95 species of native fishes once inhabited the river.

North Carolina was ruled out as the location for the first reintroductions. Steve Fraley,

is harder to measure than pollution that comes from the end of a pipe. "Even if the paper mill went away tomorrow," Fraley said, "these sources would still have an effect on the water quality of the river."

The lower Pigeon, not far from where it joins the French Broad River north of Newport, Tenn., was chosen as the best habitat in which to reintroduce fish. Water quality there is good, thanks to dilution by tributaries and settling of pollutants and mud in Waterville Lake. The Pigeon runs 26 miles through a largely unpopulated area from the state line to Newport with Interstate 40 winding alongside the river. Fish migration in the Pigeon is interrupted where Walters Dam impounds the lake and at the paper mill, where a small dam and the release of heated effluent discourage the passage of fish. At Walters Dam, a 12-mile section of the river is bypassed with a 6-mile-long tunnel that diverts water to a hydroelectric generating facility on the border with Tennessee.

### Finding the fish

Biologists collected fish and mussel species from area streams to place in the lower Pigeon. The first fish reintroduced were small, nongame species—the blueside darter, bluebreast darter and gilt darter—that appear to favor the highly oxygenated riffle habitat at the primary release site.

To assess survival of relocated species, fish were tagged with a fluorescent, medical-grade silicone that is injected as a liquid and cures to a pliable solid. This tag was placed just under the skin so its color would be visible to the naked eye in daylight. In low light, a blue LED was used to enhance tag visibility. Different colors of tags represented the river source, the season and the year of collection.

Snorkelers were used to find surviving fish. In this survey method, each snorkeler is

tethered with a rope around one ankle. The rope is attached to a reel which is used by a tether manager to keep his snorkeler in a straight line with the others. Snorkelers communicate with hand signals. When one of the target species is sighted, the line of snorkelers halts. The species and the color of the tag are recorded on a waterproof slate by an observer.

During last year's snorkeling surveys, a total of 102 gilt darters were located at seven sites. The presence of untagged fish indicated reproduction and successful re-establishment of gilt darters in the Pigeon River. Bluebreast and blueside darters were much less numerous. Some scientists think that these two fishes might have migrated to more suitable habitat downstream. A habitat survey conducted this spring on the lower Pigeon located potential habitat sites for the bluebreast and blueside.

### Fish and floods

Reintroductions of targeted species began this year in North Carolina above Waterville Lake. In March, the first two species, the saffron shiner and mirror shiner, were collected from above the paper mill and released downstream at the Ferguson Bridge. This initial effort was followed by the reintroduction of two more species, the telescope shiner and silver shiner. In August, the same four species were reintroduced again. Fraley said that because telescope shiners are especially sensitive to high levels of silt in the water, researchers decided to use them as a "canary in a coal mine" to learn more about the impacts of nonpoint source pollution. That is, if surveys later revealed that the other three shiner species were doing well but the telescopes weren't, biologists could deduce that nonpoint source pollution was to blame. Unfortunately, that research was delayed by Mother Nature.

In September, hurricanes Frances and Ivan brought heavy rains and caused unprecedented flooding of the Pigeon twice in a 10-day period. Sections of I-40 below Walters Dam collapsed into the Pigeon River Gorge. The floods inundated and ruined much of downtown Canton and damaged the paper mill, shutting it down for almost three weeks. The stormwater also flushed thousands of gallons of gasoline and fuel oil into the river, as well as untreated sewage from the plant and towns along the river.

Fraley believes that most of the shiners transplanted to the North Carolina section of the Pigeon were probably wiped out by

the monumental flooding and chemical spills that followed the hurricanes. Undaunted, he plans to repeat the reintroductions next year using the same spring-summer schedule implemented this year. The hope is that the shiners will become established over the course of a few years, assuming the river does not flood 13 to 15 feet above its normal level, as it did this fall. "It kicked us back to square one," Fraley said, "but even without the flood, those shiners are hard to find in the river, and we couldn't be sure of their survival. We learned a lot about how to mechanically catch and move fragile minnows, and about working together successfully with a disparate group of cooperators." The project steering committee plans to meet this winter to assess the situation and explore possible changes in reintroduction strategy.

### Continuous improvement

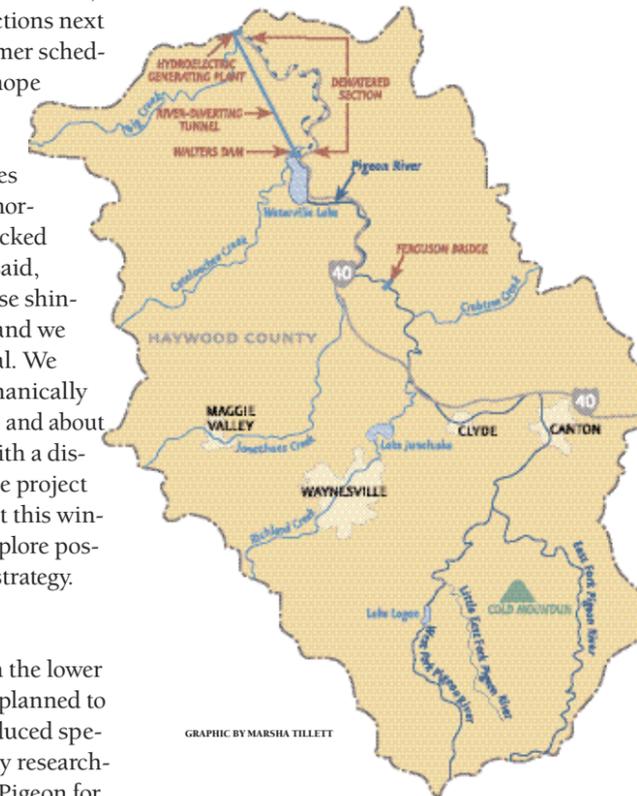
Reintroductions will continue in the lower Pigeon, and snorkel surveys are planned to monitor the progress of reintroduced species. Western Carolina University researchers will study fish habitat in the Pigeon for a year, adding data to the knowledge base scientists have already accumulated.

Biologists will try to propagate the tangerine darter again next spring, with the goal of reintroducing it on both sides of the state line. The first attempt at propagating tangerines failed last year, possibly because an aquarium environment was too stressful for adult tangerines. Juvenile fish collected in August may adapt more readily. If they spawn, their offspring will be kept for about a year to mature and increase their chances of survival in the wild.

The paper mill, which historically has been the scourge of the river, is on schedule to meet its ultimate standard for industrial discharge. That goal is still a couple of years away, but already the mill's effluent no longer contains dioxins in measurable quantities. Now a worker-owned operation, the mill is striving to improve the color and reduce the temperature of its wastewater.

Downstream at Walters Dam, hydroelectric producer Progress Energy is paying at least \$100,000 each year into a fund that benefits projects designed to improve water quality, enhance fish and wildlife habitat and increase access to the Pigeon and French Broad. The dam's federal license, renewed in 1994, stipulates that if and when water

## Pigeon River Area



GRAPHIC BY MARSHA TILLET

**COLD, CLEAN WATER FROM THE UPPER** Pigeon River flows into Canton. There, a paper mill deposits heated wastewater that halts downstream movement of cold-water fish species. Researchers reintroduced native fish at Ferguson Bridge, just upstream of where solid pollutants settle in Waterville Lake. A 6-mile-long tunnel diverts water from a section of river that stretches from the lake to the state line, where the hydro plant is located.

quality on the Pigeon improves to meet specific high standards, the company must rewater the bypassed section of the river below the dam. That event could restore miles of habitat for aquatic wildlife.

Constant work and a unified focus promise to restore the Pigeon River to a treasure people in both North Carolina and Tennessee can be proud of. Within a generation, the Pigeon could truly become a river revived. ♡

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