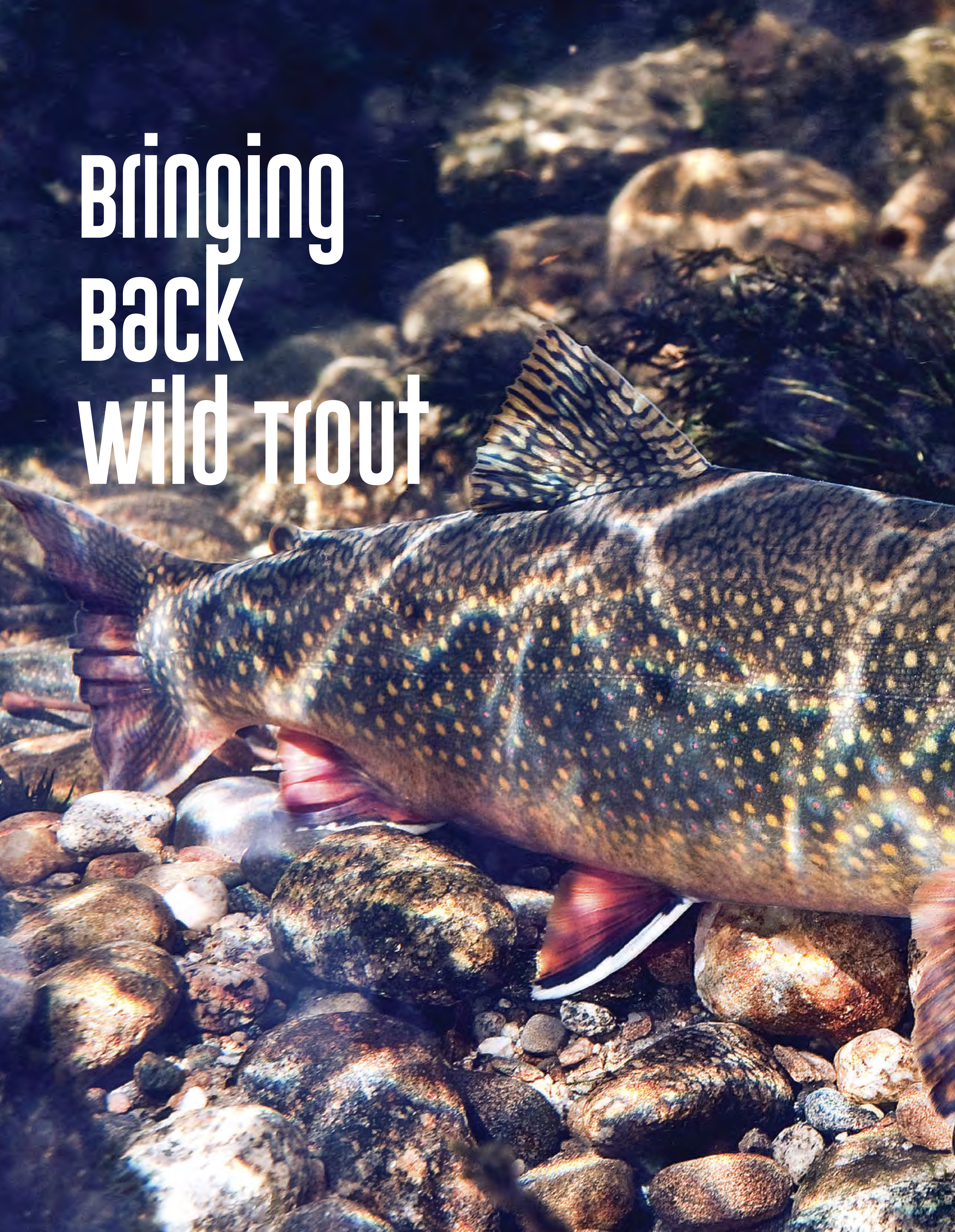
Bringing Back Wild Trout



BOB MICHELSON

Will Restoration Efforts Change Recreational Fishing?

By John A. Litvaitis

In his extensive profile, *Brook Trout: A Thorough Look at North America's Great Native Trout – Its History, Biology, and Angling Possibilities*, author Nick Karas proclaims: "Brook trout are the prettiest fish in the world." Indeed, 10 states, including New Hampshire, Vermont, New York, and Pennsylvania, celebrate brook trout as the state fish; and they are promoted as the heritage fish of Maine. These accolades are more than recognition of physical beauty; they are also an acknowledgment of the stature of brook trout in the natural world. Found in a wide range of habitats, including snow-fed mountain streams, beaver flowages, remote ponds, very large lakes (including Lake Superior), and for some, a seasonal visit to the Atlantic Ocean, the common characteristic of all brook trout habitats is cold, clean water. This requirement has prompted environmental scientists to use brook trout as an indicator species for good water quality and a well-functioning aquatic system.

Anglers eagerly seek out brook trout throughout their range. Much of this demand is met by state fish and wildlife agencies that have become very efficient in providing domesticated, hatchery-reared trout. Although wild brook trout can still be found in much of their native range, they have been in decline for quite some time. Many of the causes are known. Where development or agriculture have removed forest cover, reduced water quality and increased water temperatures have eliminated brook trout. Old dams and poorly designed stream crossings prevent seasonal movements. Intentional and accidental releases of other fish also have been a serious but often unseen threat.

Non-native bass, brown trout, and rainbow trout prey on or compete with brook trout. Combined, these forces are formidable; fortunately, they are not going unchallenged.

In 2004, a group of diverse governmental and private sector organizations joined forces to form the Eastern Brook Trout Joint Venture (EBTJV). According to Steve Perry, coordinator of this partnership, restoring wild brook trout will increase recreational fishing opportunities; more notably, it will also provide an opportunity to educate the fishing and non-fishing public about the importance of aquatic ecosystems that trout inhabit. Taking a grassroots, "we-can-do-this" approach, the EBTJV is relying on local efforts to identify problems and to find solutions. Since its formation, biologists and their partners in 17 states have been at work. What's happening in northern New England can illustrate the actions being taken and how their results may change recreational fishing.

RECONNECTING RIVERSCAPES

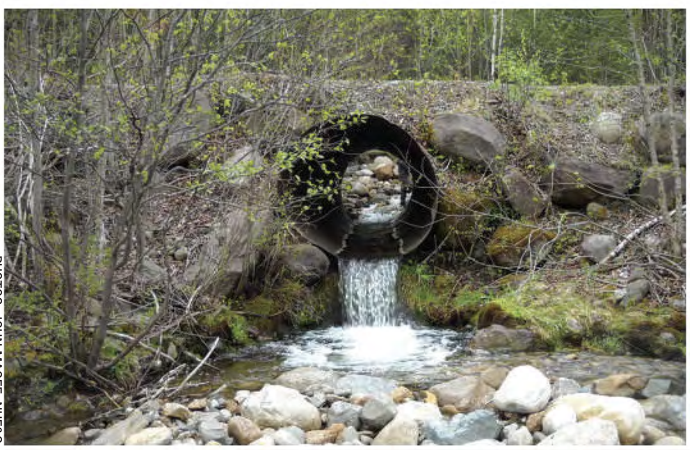
As with most animals in temperate climates, brook trout move seasonally in response to temperature changes and specific habitat needs. In summer, trout occupy deep pools or cooler portions of a watershed to avoid thermal stress. In autumn, breeding adults migrate up tributaries where groundwater seepage provides ideal conditions for reproduction and development of juvenile trout. Maturing fish use downstream habitats for feeding, and seek out pools or adjoining lakes for winter.

In northern New Hampshire, fisheries biologist Dianne Timmins monitors radio-tagged brook trout within a network of rivers and tributary streams. The extensive movements by these fish have been surprising, with some individuals traveling more than 30 miles along headwater streams, diverse main-stem river habitats, and into a large lake. Unfortunately, the majority of aquatic networks in New England has been degraded to some degree and no longer allow such movements by brook trout or any other fish. As a result, wild trout populations are often restricted to small headwater streams that substantially limit their growth.

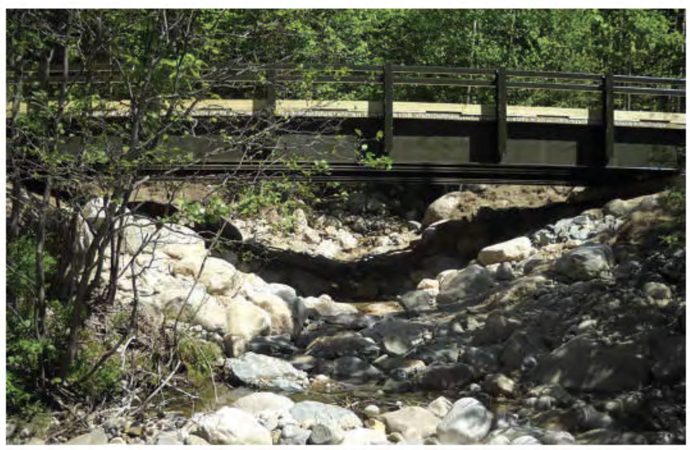
Among the most conspicuous obstacles to fish movement in New England are dams. A recent inventory of municipal and privately owned dams in New England found more than 14,000 – the highest density in the country. The largest river in the region, the Connecticut, spans 410 miles from the Canadian border to Long Island Sound. Along the Connecticut, there are 15 dams, including 9 that produce electricity. These dams are barriers to migratory populations of shad, sturgeon, alewives, herring, and Atlantic salmon that traveled up the Connecticut each spring to spawn, as well as movement of year-round residents, such as brook trout. Although fish passageways have been installed on the majority of dams, there are still more than 1,000 dams on tributary rivers and streams that continue to block migrating fish and fragment habitat. Many of these smaller dams no longer serve a useful function, and their maintenance is often more expensive than removal.

Less obvious than dams, poorly designed water crossings also impact trout habitats. Too often, these crossings become "pinch points" where streams are forced through a narrow passage or culvert beneath a road. Over time, the effects of varying water levels at these crossings can change the physical characteristics of the stream and make it a barrier to fish passage. During periods of high water flow, the funneling effects caused by the narrow culvert result in scouring of the channel immediately downstream. As rocks and gravel in the streambed are pushed downstream, a pool forms below the culvert. Continued scouring eventually results in a hanging or "perched" culvert where the downstream portion of the culvert is well above the water level of the stream.

PHOTOS: JOHN MAGEE, NHF&G

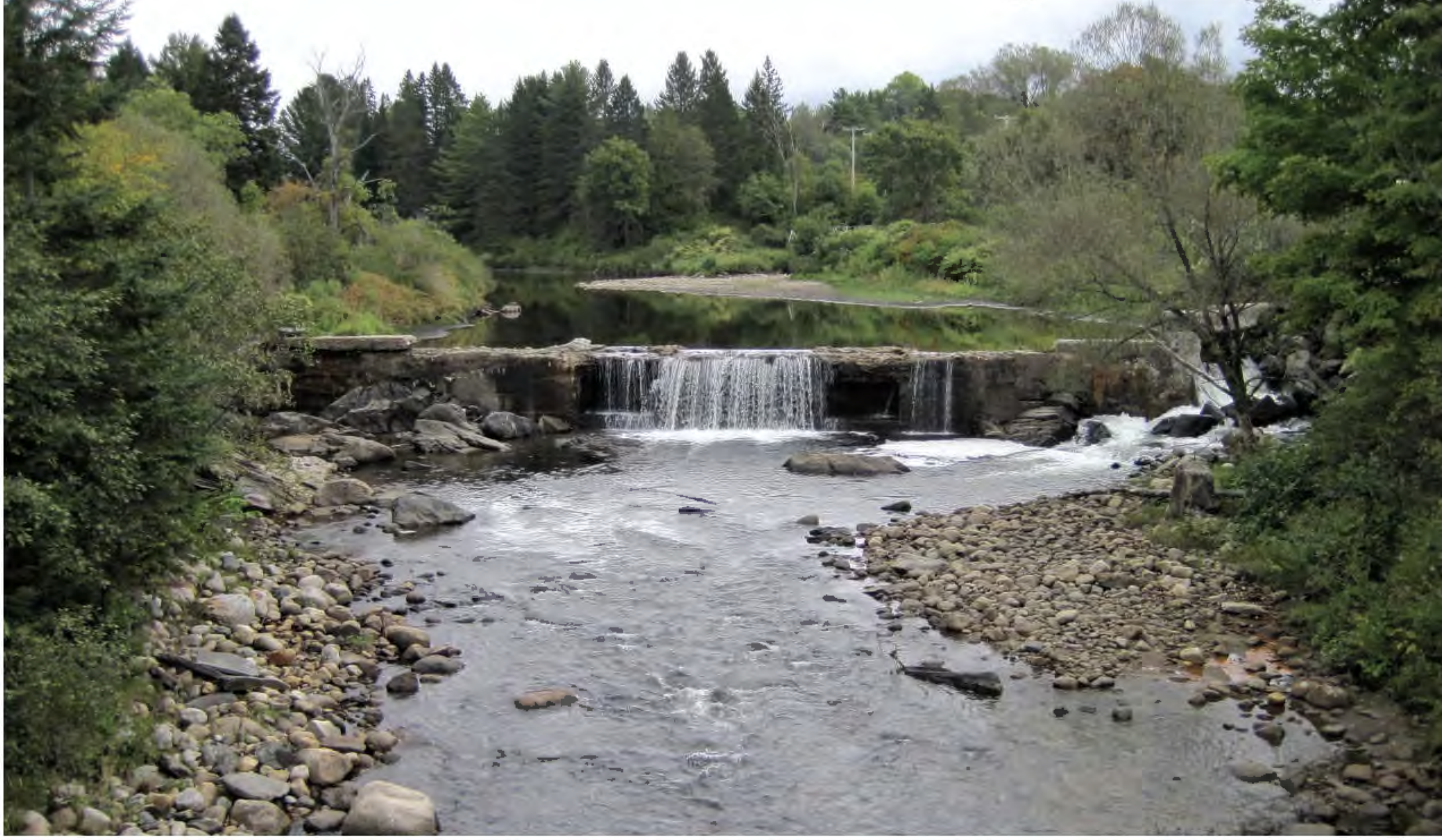


Perched culvert preventing fish movement on Slide Brook, New Hampshire.



Free-flowing Slide Brook after culvert was removed.

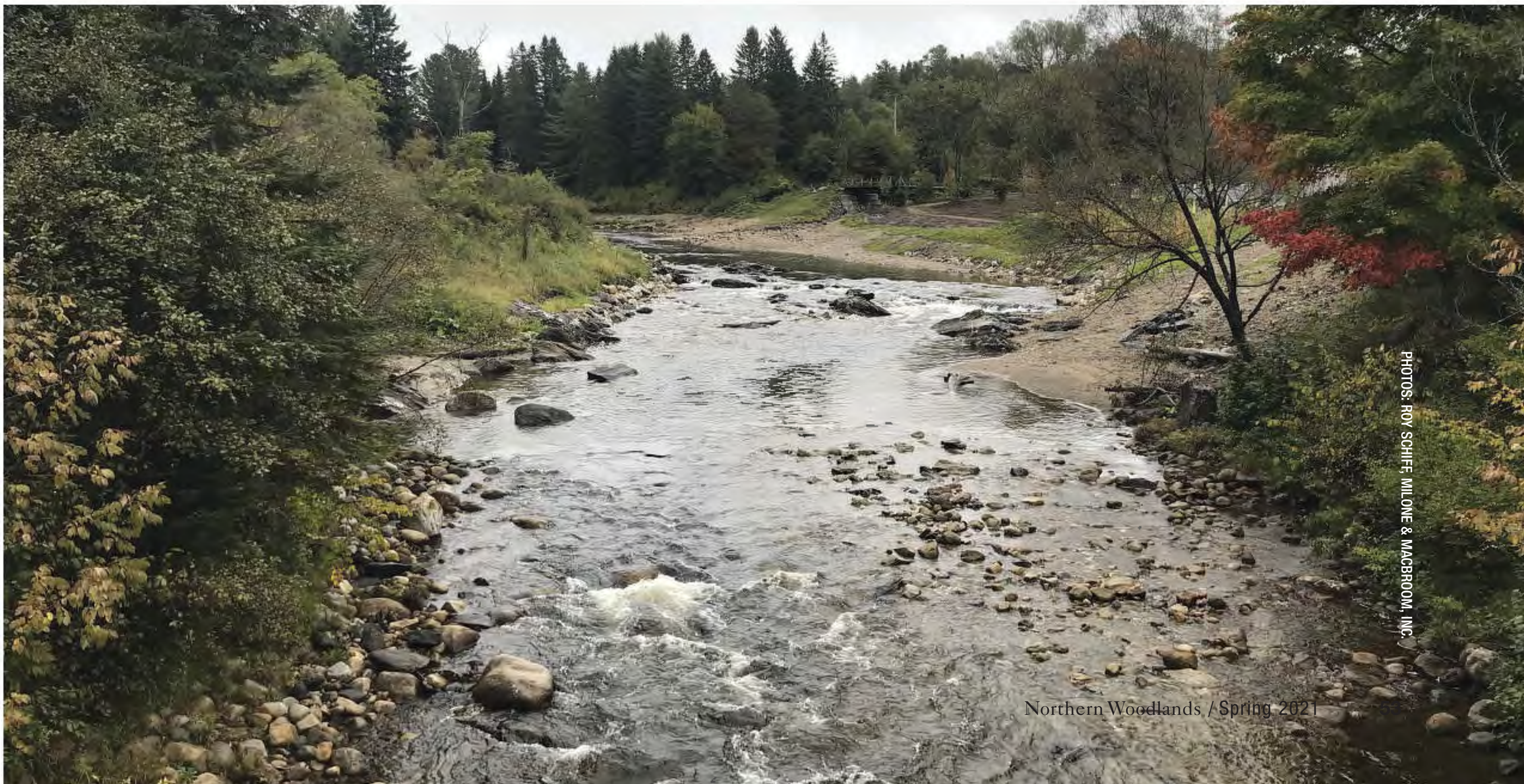
In New Hampshire, fish habitat biologist John Magee demonstrated that perched culverts function similar to dams by preventing upstream movement by brook trout. His observations were corroborated in neighboring Québec, Canada, where biologists used genetic information to reveal that the effects of perched culverts were similar to a natural waterfall more than 6 feet tall. The prevalence of failing culverts is widespread. For example, more than 90 percent of 3,000 culverts examined in Vermont limited movements of fish or other aquatic animals. As a result, removing problematic culverts is a priority of the Eastern Brook Trout Joint Venture.



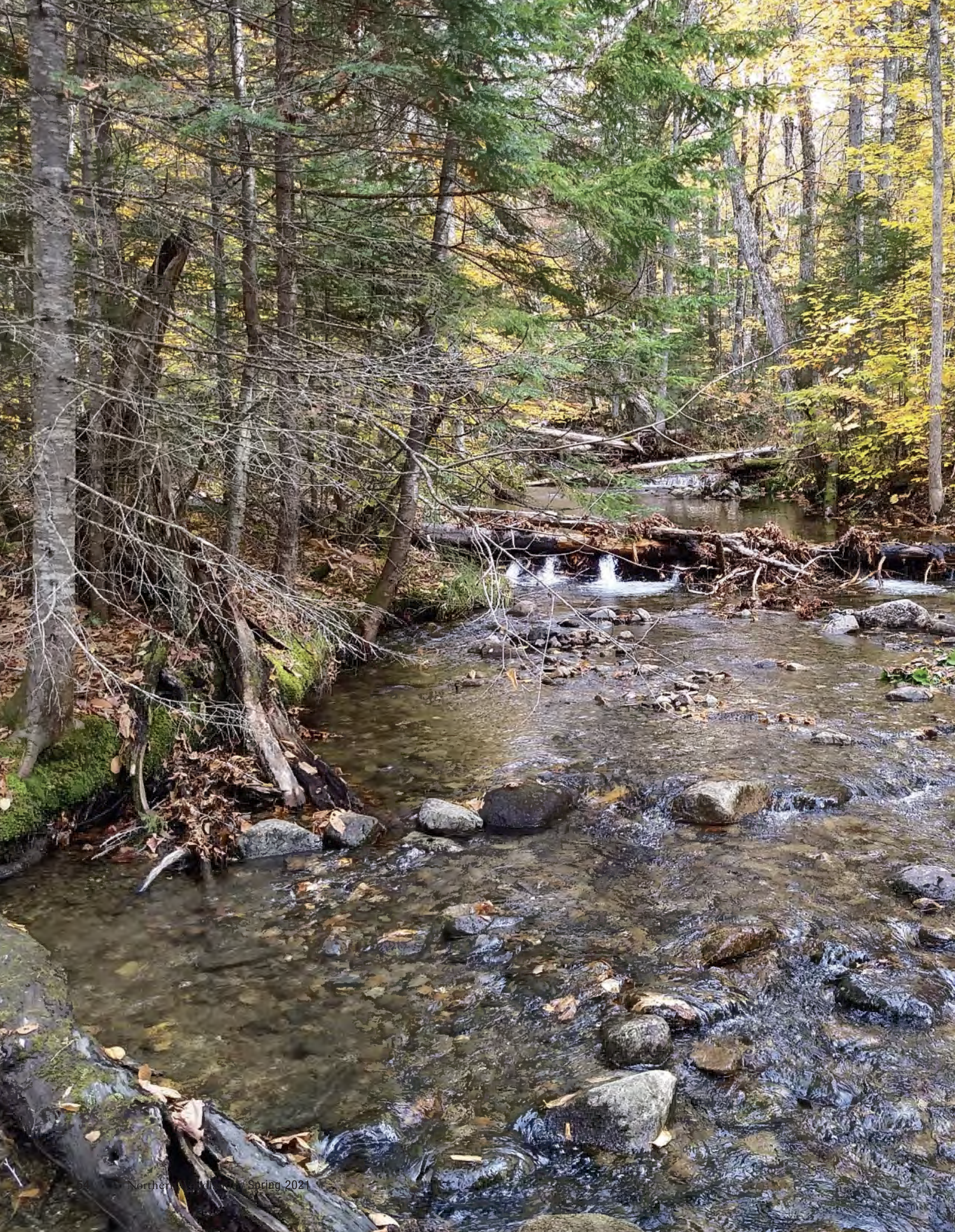
Dam on the East Branch of the Passumpsic River, Vermont.

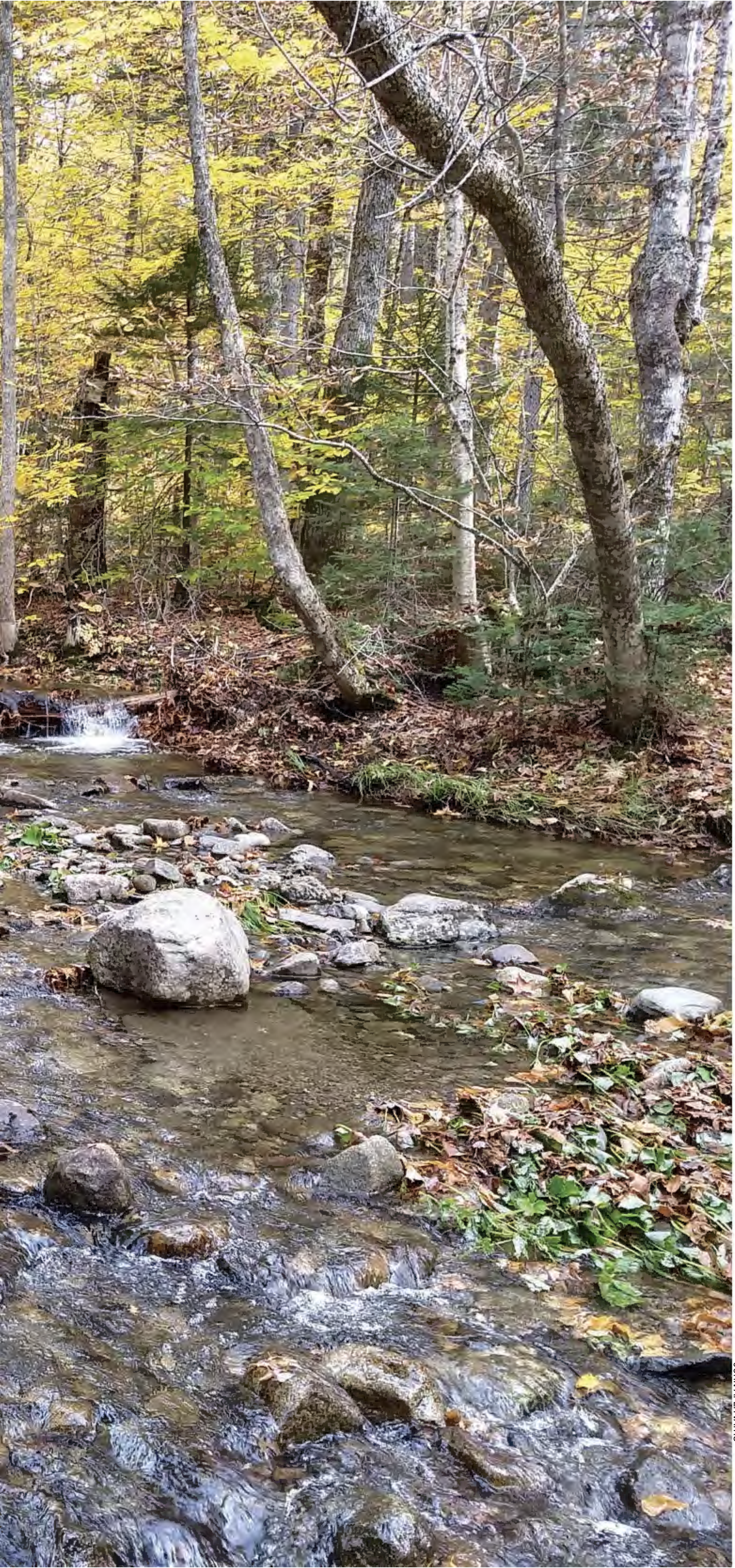
Identifying and prioritizing "deadbeat" dams for removal in the Connecticut River watershed has become a major undertaking by the Connecticut River Conservancy. In 2017, the Conservancy partnered with Passumpsic Valley Land Trust and the Eastern Brook Trout Joint Venture to remove the dam on the East Branch of the Passumpsic River in East Burke, Vermont. That concrete dam, built in 1931, was at the same location as a timber crib dam that was first built in 1825. Dam removal has allowed brook trout and other aquatic animals to move throughout a 99-mile system of rivers, streams, and headwater habitats. Since 1990, more than 130 dams have been dismantled in New England, including large dams on the Kennebec and Penobscot rivers in Maine. More will be coming down.

Free-flowing Passumpsic River after dam removal.



PHOTOS: ROY SCHIFF, MILONE & MACBROOM, INC.





JOHN A. LITVAITIS

IMPROVING STREAM PRODUCTIVITY

Where wild brook trout populations still occur, they are typically limited to headwater streams. Such streams are often characterized by low nutrient content and shallow, rapid water flow that limit fish abundance and their size. Brook trout do best in streams with occasional deep pools where they aren't constantly working against the current, are able to feed, and find cover from potential predators. Fishery biologists have recognized that trees, logs, and even large branches that fall into a stream can improve conditions for trout. Instream wood changes how water flows, often creating a pool on the downstream side of a fallen tree or log. In addition to diversifying stream structure, wood directly adds organic matter and also captures floating leaves and other materials that fall into a stream. As wood and other materials decay, they provide nutrients for aquatic insects that are essential for brook trout. In northeastern Vermont, biologists Jud Kratzer and Dana Warren compared brook trout populations in 33 headwater streams to such features as water chemistry, water temperature, stream width and depth, abundance of pools, and the amount of instream wood. They found that the amount of instream wood was among the best predictors of brook trout productivity in a stream.

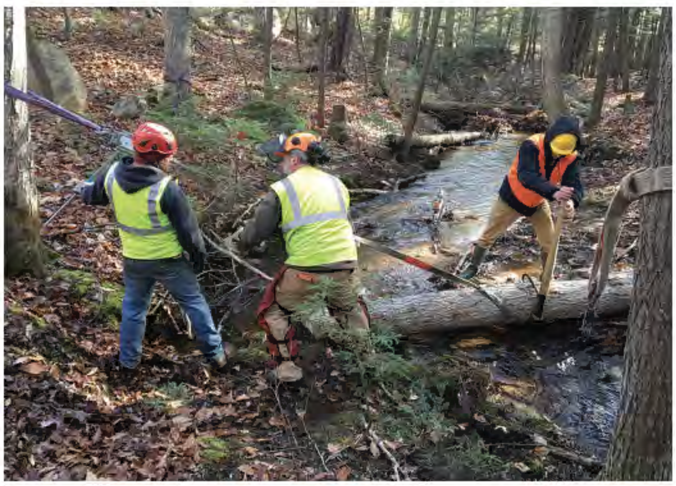
The amount of instream wood varies with the age of the forest surrounding the stream, with more occurring in old forests. With a long history of land clearing and timber harvests throughout New England, most forests are relatively young with little instream wood. As a result, there is substantial interest in adding wood to some streams. Fishery biologists are teaming up with foresters to design projects that put logs and even whole trees into streams to enhance habitat. Results of these efforts have been encouraging. In New Hampshire, John Magee partitioned Emerson Brook into three sections: a control (no wood added) and two experimental units (wood added). Whole trees and logs were

Instream wood enhances the physical structure and productivity of Pike Brook, New Hampshire.

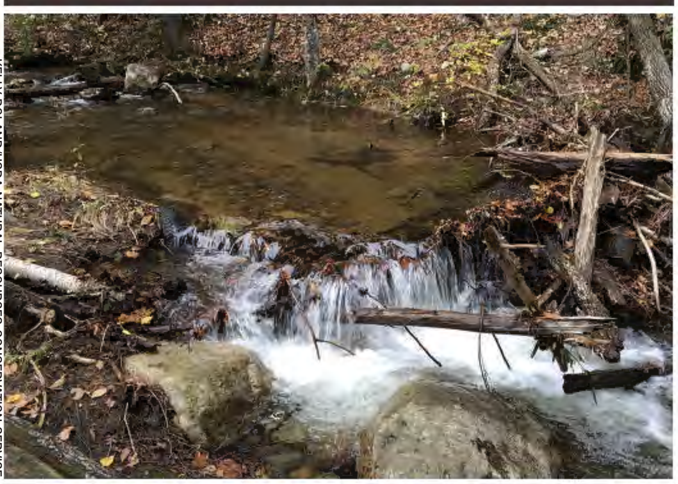
placed into the experimental units in 2009 and 2012. By 2014, the stream sections with wood additions had approximately 10 times more adult brook trout and 4 times more juvenile trout than the control segment. Some of these increases were likely a result of fish simply moving into the experimental sections. But Magee believes that fish in areas where wood was added were able to avoid predators, forage more efficiently, and thus became more abundant.

THE THREAT OF INTRODUCED FISH

In much of New England, non-native smallmouth bass have become common in ponds, lakes, and rivers that once supported brook trout. In many instances, bass were intentionally released more than a century ago. Coinciding with these early introductions, forest clearing for agriculture and development degraded some aquatic habitats by increasing water temperature. Bass are much more adaptable than brook trout to such changes and quickly took over. As a result, where it's not practical to restore watershed habitats, there is no going back to brook trout – the bass are here to stay. But in other situations, removing or at least reducing the abundance of non-native fish may be possible and may benefit wild brook trout. (See *Northern Woodlands*, Summer 2016 for an in-depth look at an effort to remove smallmouth bass from the nationally renowned Rapid River in western Maine in support of wild brook trout.)



Above: Adding instream wood in New Hampshire.
Below: Presence of instream log results in formation of a pool.



KELLY BOLAND/USDA NATURAL RESOURCES CONSERVATION SERVICE

Some fish additions are sanctioned by state fisheries agencies and management plans, but supplementing wild trout populations with hatchery-raised fish also can be problematic. Hatchery fish are added to streams and ponds when the size or abundance of wild trout are considered insufficient to meet angler expectations. Although this can provide short-term rewards for anglers, hatchery fish can introduce diseases, parasites, or pests that affect wild fish. Hatchery fish also may interbreed with wild fish, resulting in offspring that are less adapted to their environment. Fortunately, evidence suggests that the impacts on the genetics of wild brook trout have been minimal so far, largely because few hatchery fish survive long enough to breed.

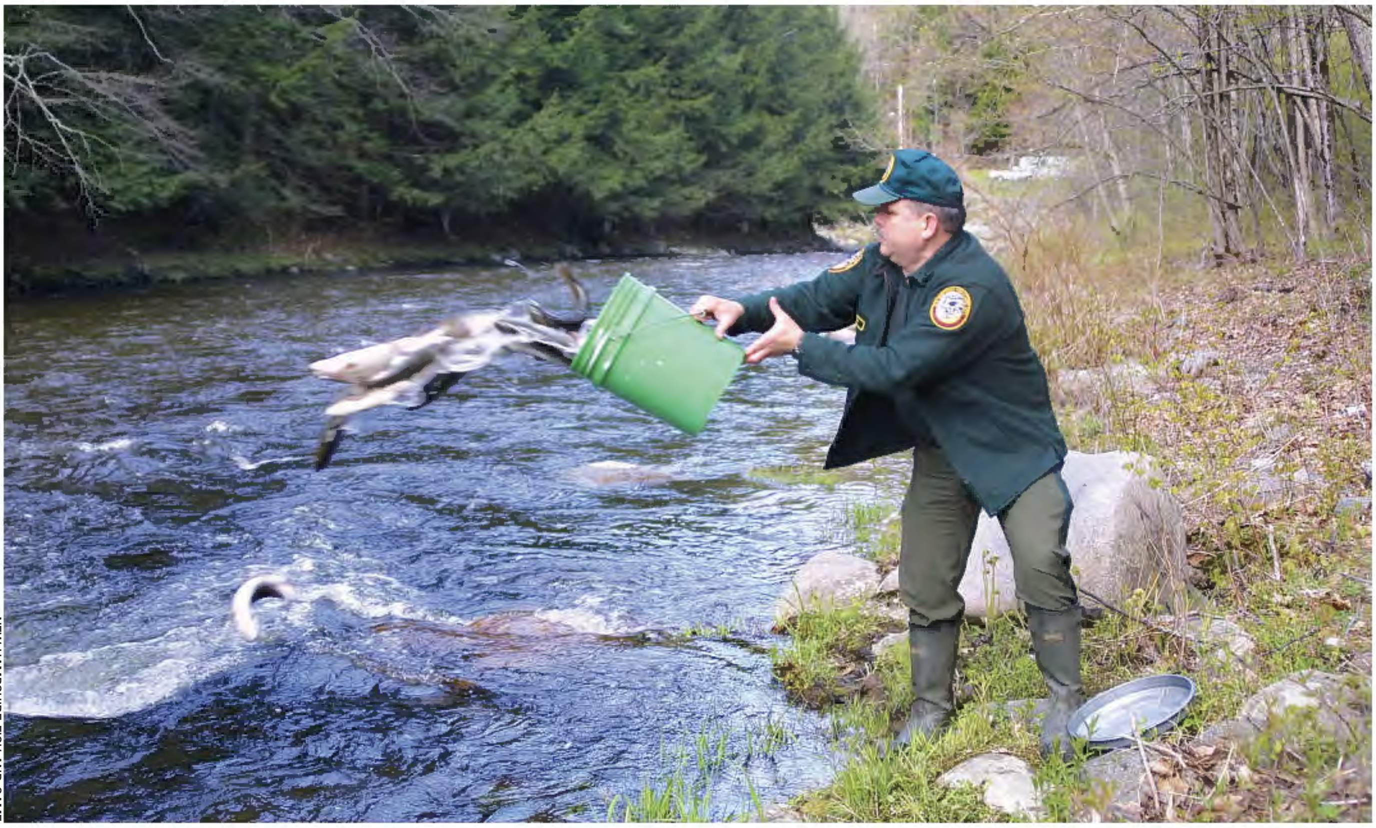
There are other differences between hatchery-raised and wild fish to consider. Hatchery fish are selectively bred to grow fast, and they are reared in an artificial environment that does not prepare them for life in the wild. On the other hand, wild trout have evolved in an environment that constantly challenges them. They are adapted to select sites where they can efficiently feed and minimize exposure to predators.

A CHANGING ROLE FOR HATCHERIES?

Reliance on hatcheries is widespread in New England. Consider current stocking levels. In 2019, Maine released 623,423 catchable-size (yearling or older) trout and salmon (approximately 2 fish/licensed angler), Vermont stocked 625,889 similar fish (approximately 5/licensed angler), and New Hampshire released 981,379 catchable fish (approximately 6 fish/licensed angler). The estimated cost of raising and releasing a yearling fish is more than $3, and anglers don't catch all stocked fish. According to fisheries biologist Jud Kratzer, return-to-creel rates (percentage of hatchery-stocked fish that are harvested by anglers) of 40 to 50 percent are a reasonable approximation. That means anglers harvest no more than half of stocked fish, with the remainder eaten by predators such as mink, otters, or a lucky heron or simply dying. Additionally, Vermont biologists have shown that the number of hatchery fish added to a stream (stocking density) has little influence on angler-catch rates (fish caught/hour), the parameter used to gauge angler satisfaction. Given the budget shortfalls that all state fish and wildlife agencies are currently experiencing, it seems likely that the level of fish stocking will be reconsidered.

Yet some anglers have come to expect that their local fishing hole will produce, at least early in the season. Fewer visits by the hatchery truck can result in calls to conservation officers. "Squeaky wheels" do get attention. Agency administrators are especially concerned that dissatisfaction among some anglers will result in a drop in fishing license sales.

On the other hand, well-known northern New England lakes such as Moosehead, Winnipesaukee, and Champlain, and large



Releasing hatchery-raised trout – helping or hurting?

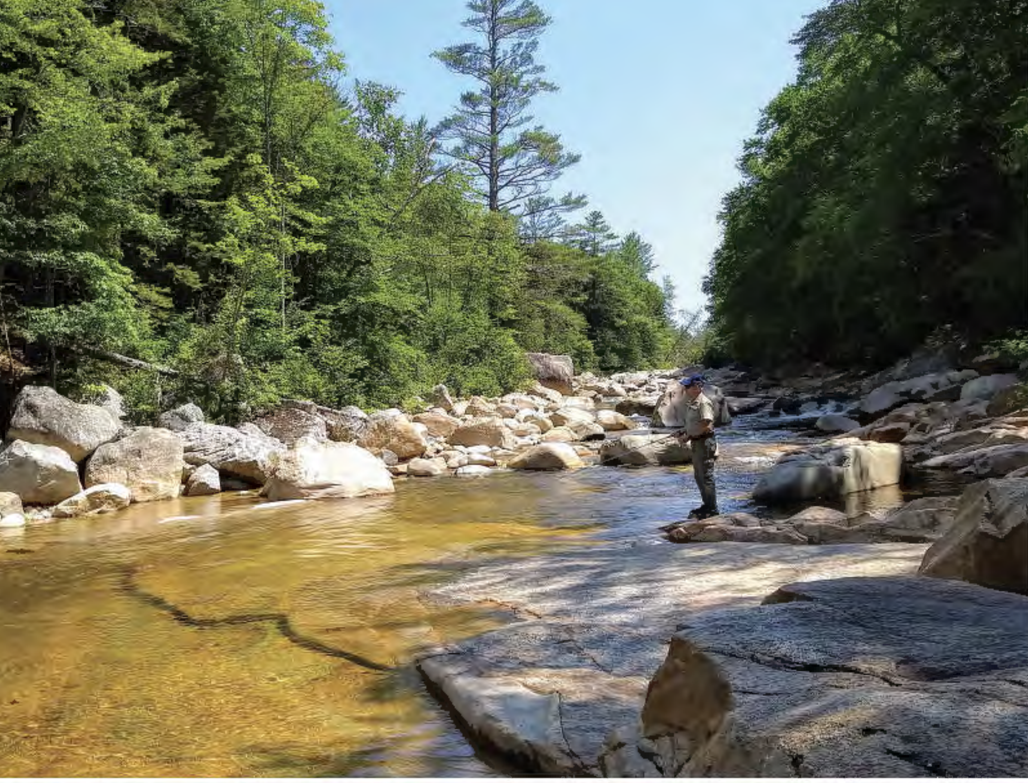
More than 40 years ago, Robert Bachman (then a graduate student) conducted a study along Spruce Creek in western Pennsylvania where he made detailed observations of the activities and interactions of hatchery-raised and wild brown trout. Using concealed observation points, Bachman was able to differentiate wild from domesticated trout by their color and spotting patterns. After months of monitoring, several patterns emerged. When first released, hatchery fish spent more time searching for food than did wild trout, often without success. Working harder and eating less reduced the condition of hatchery fish and made them vulnerable to mortality. Hatchery fish were also naïve to the body signals that wild fish used to defend their established feeding positions. As a result, hatchery fish often bullied wild fish from their preferred feeding spots, causing them to feed less. At the end of two years, Spruce Creek had fewer trout than it did at the start of the study. Both hatchery-raised and wild trout had low survival rates when forced to live together. These findings call into question the utility of adding captive-reared fish to wild populations.

rivers including the Kennebec, Androscoggin, and the Upper Connecticut are considered destination fisheries where angler pressure far exceeds natural reproduction and hatchery support is warranted.

MOVING TOWARD MORE SUSTAINABLE FISHERIES

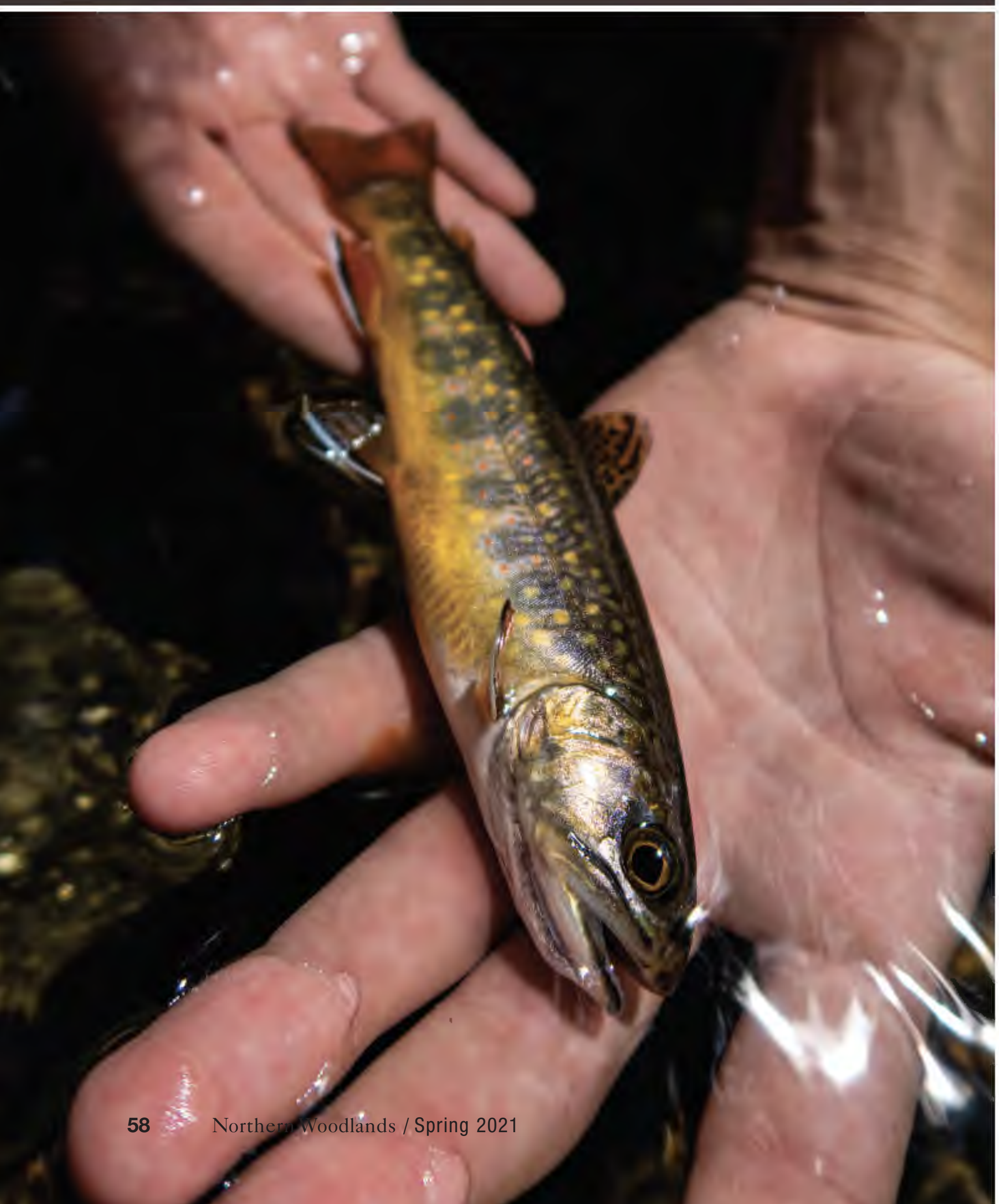
Although there is support for hatchery-raised trout, attitudes and preferences of anglers are changing. Consider the rise in popularity of catch-and-release fishing, even where it is not required by state regulations. Along the White River in Vermont, voluntary releases of caught trout increased from about 20 percent in 1972 to more than 80 percent in 2017. The number of fish an angler takes home is less important than it used to be. Anglers are also supporting actions that favor wild trout. In 2005, the Maine legislature passed the State Heritage Fish Law that recognizes and protects the state's wild, self-sustaining brook trout. Currently, there are nearly 600 lakes and ponds in Maine that have been designated as State Heritage Fish Waters that are not stocked with hatchery-raised fish and are dependent on reproduction by wild fish. In 2016, Jeff Reardon of Trout Unlimited worked with members of the Trust for Public Land and Maine Department of Inland Fisheries & Wildlife to purchase and protect 8,000 acres of forestland in western Maine that includes the Cold Stream watershed. These waters were last stocked with brook trout in 1954 and do not contain any non-native fish. The inherent qualities of Cold Stream and its regional role in contributing to the productivity of the larger Kennebec River watershed emphasize the importance of protecting intact wild trout habitats.

In neighboring New Hampshire, movement toward self-sustaining trout fisheries has been more measured. Sixteen streams and ponds have been designated as wild trout fisheries that support fish populations considered sufficiently productive to meet angler expectations of fish abundance and size. These



JOHN A. LITVAITIS

Above: Fishing for wild brook trout in the White Mountains of New Hampshire.
Below: The rewards of fishing "the thin blue line."



water bodies are managed with special regulations that include shortened seasons, catch-and-release, and no bait fishing. There are many other brooks and streams throughout the state that support wild trout; many are small headwaters where fish are short-lived and rarely grow larger than 5 to 6 inches. Among wild trout streams that can be easily accessed, some are stocked with larger hatchery fish to fulfill angler expectations. But for other anglers, wild trout have become a satisfying quest. "Fishing the thin blue line" (or venturing to brooks and small streams found on topographic maps) is the motto of those anglers eager to pursue wild fish.

Combined, current actions by the EBTJV show movement toward more sustainable sport fishing. Reconnecting fragmented riverscapes by removing outdated dams and replacing poorly designed culverts has made substantial improvements to brook trout habitats. Since 2006, the EBTJV has directly supported one hundred eight projects that eliminated fish passage barriers, which resulted in providing brook trout renewed access to three hundred eighty-two miles of cold-water habitat. Reducing the threat of non-native fish may require additional safeguards, including restrictions on the use of baitfish that are often poured into a stream or pond at the end of a fishing trip. The role of hatcheries also warrants additional consideration. Supplementing a suitable lake, pond, or stream with hatchery-raised fish when angler demands are greater than the water body is capable of supporting seems to be a realistic management action. On the other hand, adding fish to a stream or pond with wild trout that are already limited by their environment or releasing fish into unsuitable habitats simply to provide several weeks of fishing seems to be poor use of limited resources. Additional changes to trout management will take time; but then again, patience is something anglers have.

John A. Litvaitis is an emeritus professor of wildlife ecology at University of New Hampshire. He advocates for greater public involvement in developing wildlife policies and aids in efforts to monitor large carnivore populations in the Baltic region of Europe.