

Background

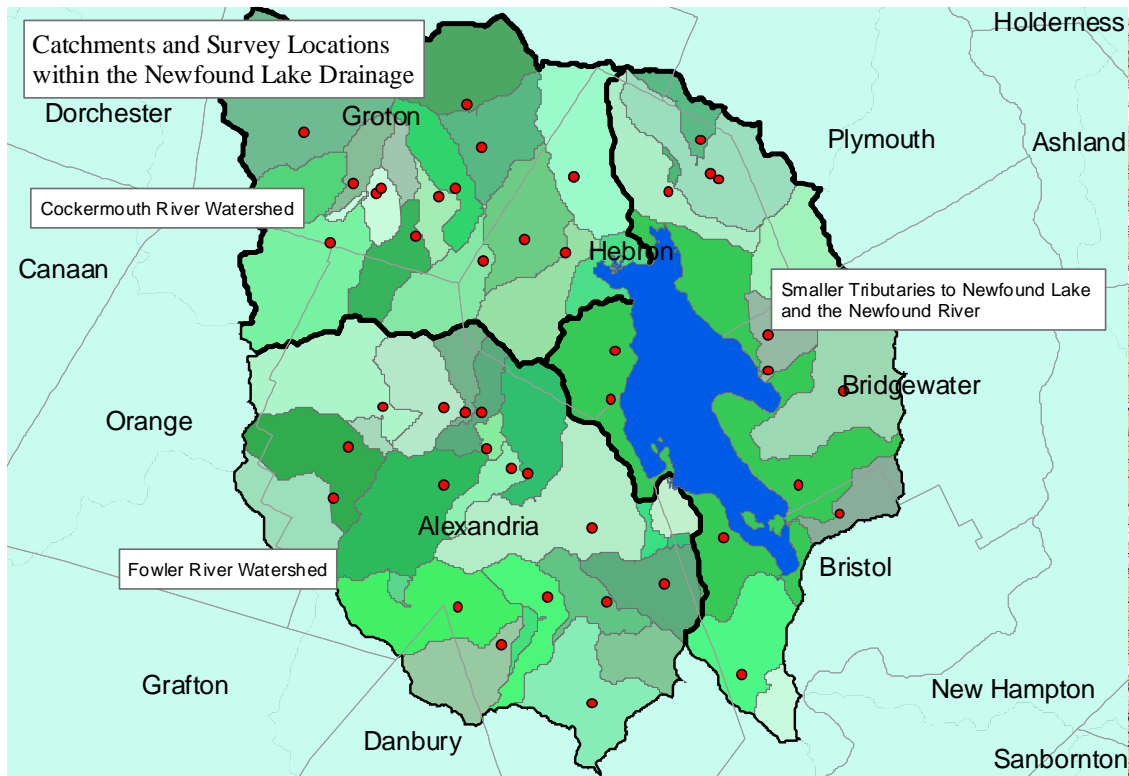
Brook trout are the only native stream dwelling trout species in New Hampshire, having a historic range that extended from Georgia to eastern Canada. It is believed that wild brook trout were once present throughout all watersheds in New Hampshire. Increased stream temperatures, changes to water chemistry, habitat fragmentation, increased rates of predation and competition, loss of spawning locations, and the loss of stream habitat complexity have led to reduced and isolated populations of wild brook trout both in New Hampshire and throughout the species native range in the eastern portions of the United States.

Recognizing the reduction in the distribution of wild brook trout, the Eastern Brook Trout Joint Venture (easternbrooktrout.org/) was established. This public and private partnership of state fish and wildlife agencies, federal natural resource agencies, academic institutions, and local conservation organizations is working to protect existing wild brook trout habitat, enhance and restore impacted habitat, and raise public awareness about their current status. These efforts will also benefit other native stream dwelling species, because brook trout serve as an indicator for healthy aquatic ecosystems. Fortunately, New Hampshire has more intact populations of brook trout (meaning more than 50% of a sub-watershed's habitat is occupied by wild brook trout) when compared to the southern portions of the species eastern U.S. range. However, information to quantitatively describe the status of brook trout populations in New Hampshire is limited.

To assess the status of brook trout within the Newfound Lake drainage, the New Hampshire Fish and Game Department (NHFGD), Pemigewasset Valley Trout Unlimited, and the Newfound Lakes Region Association conducted electrofishing surveys during the summer of 2009. The scale used in the Eastern Brook Trout Joint Venture required that the Newfound Lake drainage be divided into three watersheds. These watersheds include: the Cockermouth River watershed, the Fowler River watershed, and a combination of the Newfound River and smaller tributaries that enter Newfound Lake.



In order to summarize the status of wild brook trout populations within the three watersheds within the Newfound Lake drainage, each watershed was further broken down into smaller catchment drainages. Every catchment that had suitable depth for electrofishing was surveyed. Some catchments were not surveyed because depths were too great. In addition to length and weights of fish captured, information that described current brook trout habitat condition was collected.

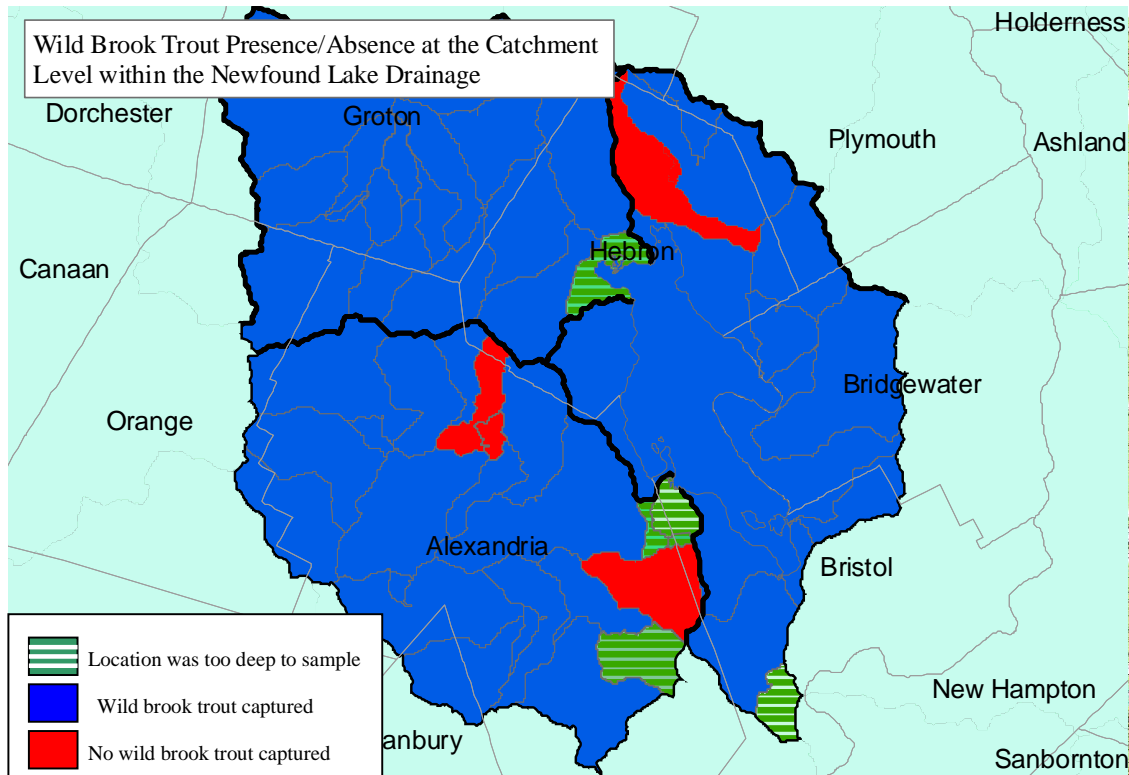


Results

A total of 14 different species of fish were captured at 47 locations within the Newfound Lake drainage. Wild brook trout were the most dominant species found in the Cocker-mouth and Fowler watersheds while margined madtom were the most abundant species in the Newfound River watershed, though brook trout were the second most abundant species. Other species captured within the Newfound Lake drainage include: brown bullhead (hornpout), blacknose dace, burbot (cusk), creek chub, common shiner, fallfish, hatchery-reared brook trout, landlocked salmon, longnose dace, slimy sculpin, white sucker, and yellow perch. Of particular interest is the large abundance of wild landlocked salmon found in the Cocker-mouth River. These juvenile fish are believed to be the offspring of landlocked salmon that are routinely stocked into Newfound Lake as yearlings.

To explain the current status of wild brook trout at the watershed level, fish data from each catchment was assembled. Since there is over 120 miles of stream within these

three watersheds that could not be completely surveyed, the assembled fish data from the catchments was used to illustrate a representative description for the entire watershed.



The surveys show that all three watersheds within the Newfound Lake drainage have intact populations of wild brook trout. Not only do these watersheds offer aquatic habitat suitable for wild brook trout, the overall magnitude of brook trout abundance is suspected to be unique for central New Hampshire and perhaps at the state level. Currently, wild brook trout are not necessarily rare in central New Hampshire, but the projected status of wild brook trout in this drainage is exceptionally good. Adjacent watersheds have suitable habitat for wild brook trout but not to the extent shown by the surveys in the Newfound Lake drainage.

Possible impacts to wild brook trout were recorded at every survey location. The lack of riparian vegetation as a result of logging, lawns, or adjacent road presence was the most common impact recorded. Subsequent increased erosion rates were observed at these locations. Perched culverts, livestock accessing streams, extensive stream bank armoring with riprap, washed out pavement entering the stream and litter were also noted in some locations.

The opportunity to protect intact populations of wild brook trout is uncommon, even in New Hampshire. Land conservation and guidance on land use practices are essential to protecting brook trout habitat. Wild brook trout populations and humans can coexist, but concerted efforts must be made to limit impacts to their habitat. Land and water use guidance should be given for streams of all sizes within a watershed as smaller streams are often used for spawning and nursery areas. Presumably minor human impacts to these streams can be additive throughout the watershed and create problems that are not readily apparent until further downstream. Land use practices do not necessarily have to be limited or halted in these areas; they may just have to occur in ways that minimize their impacts on brook trout and their habitats. The cost to restore a population of any species is always higher than the cost to protect them. Restoration actions require a great deal of effort and may not always guarantee self-sustaining populations would return.

Wild brook trout depend on cold, well-oxygenated water and access to a variety of aquatic habitat types. If streams become too warm and oxygen deprived, wild brook trout populations can be significantly impacted. This is often observed when land use practices remove shoreline vegetation that shade and cool streams. The presence of impoundments can slow water and allow the temperature to warm; altering aquatic habitat into something more desirable to non-native species (i.e. smallmouth bass). Stormwater discharged into streams from large sun-warmed impervious surfaces (i.e. large parking lots) can raise stream temperatures, as well as increase the amount of sediments and pollutants entering the stream.



Parking lots without riparian buffers or consideration of where stormwater is discharged can increase stream temperatures, sedimentation rates, and levels of hazardous materials.

When streams have increased sedimentation rates from anthropogenic causes, spawning gravel needed for brook trout reproduction is often covered or embedded. This reduces natural reproduction rates. Slower moving reaches of streams where excess sediments settle are often prone to widening; becoming warmer and shallower habitat not suitable for brook trout. Sedimentation can result from several different land use practices: stream crossings that are undersized increase stream velocities that amplify erosion and subsequent sedimentation rates; dirt roads that are constructed near streams with no riparian buffer that collapse or wash into streams; and impervious surfaces causing stormwater to discharge into streams at high velocities.



Road design that directs storm water runoff into streams increases erosion and sedimentation rates. This can alter stream habitat and cover spawning substrate, significantly impacting wild brook trout.

Wild brook trout are not often thought of as migratory fish and subsequently not often considered during roads design. However, radio telemetry studies by the NHFGD have shown larger wild trout can move over twenty miles in a single year. When crossings that alter stream flow and sediment transport are installed, impacts to stream habitat and migration can occur. Improperly sized culverts that speed water flow often become perched overtime, making upstream passage difficult for many aquatic species. This can reduce access to spawning habitat or upstream refuge areas where water temperatures may be cooler. Under sized culverts may also act as a barrier that can isolate populations. If an isolated brook trout population is severely impacted by anchor ice in the winter or a flush of acidic water from spring run-off or storm events, then the affected area may not be able to repopulate. Genetic diversity is also a concern with isolated populations. The migratory needs of other fish species are represented by the presence of wild landlocked salmon in the Cockermouth River watershed. In the fall, adult landlocked salmon ascend lake tributaries to spawn. Juvenile landlocked salmon were captured over four miles upstream from the Cockermouth River's confluence with Newfound Lake.

Although stream crossings that consider sediment transport and fish passage in their design may cost more to design and install, overtime, these crossings are expected to have greater longevity and less maintenance costs. Additionally, the steep natural topography of several streams within the Newfound Lake drainage creates several falls and cascades that already potentially limit fish mobility. This increases the need for all stream crossings to be designed to allow for adequate fish passage.



Georges Brook-Hebron. Wild brook trout were found downstream of this culvert and no fish were found for the next 100 meters above the culvert. Road crossing design that does not incorporate fish movement can reduce fish dispersal. Opportunities for fish to repopulate an area or reach more desirable habitat has been reduced.

Local Strategies for the Conservation of Wild Brook Trout

Headwater Stream Protection

The level of protection for headwater streams varies by town and is usually accomplished through zoning ordinances, so local zoning ordinances should be reviewed to determine whether they provide sufficient protection. Best management practices for agriculture and silviculture should also be promoted among landowners who abut headwater streams. Local environmental stewards need to be attentive and vocal when projects are proposed within the watershed that could impact aquatic systems. The Comprehensive Shoreline Protection Act (RSA 483-B) already offers some regulatory protection for the Newfound River and lower portions of the Cockermouth and Fowler rivers. At a minimum, 100 feet (30 meters) of naturally vegetated buffers along all streams should be maintained. Preferably, vegetated buffers should be 300 feet (~100 meters). As buffer widths increase, more terrestrial species will use the wooded area as a travel corridor. Additionally, vegetation slows sediment and pollutant laden stormwater before it enters an aquatic system. Stormwater drainage designs that discharge directly into the stream should be avoided in favor of systems that filter stormwater into the ground. Maintaining larger riparian areas also allow for trees to fall into streams. The presence of large woody debris creates pools, cover, and complex habitat for fish species as well as bank stability.

Taking steps to protect headwater streams will prevent irreversible losses to New Hampshire's biodiversity as well as save countless dollars by protecting water quality and preventing flood damage. Therefore, communicating these protective measures to local policy makers is imperative.

Stream Crossing Inventories

Stream crossings should be evaluated within the Newfound Lake drainage to determine if they are degrading habitat and/or obstructing fish passage. Results of this crossing inventory in conjunction with fish survey data should be communicated to local road agents and the New Hampshire Department of Transportation so that stream crossing upgrade projects can be prioritized.

Public Outreach and Education

Educational programs should be developed to inform both children and adults about the importance of the link between the presence of wild brook trout populations and high water quality. Educators should emphasize the realization that environmental impacts caused by one person or one family in the Newfound Lake drainage could have a lasting effect on their neighbors downstream. The key is to stress the needs of wild brook trout, a species that is the essence of New Hampshire's rich heritage.

Photos from Surveys



Lower Cockermouth River-Hebron. Large trees that are allowed to fall and remain in the river system provide cover and create pool features in an otherwise barren part of the river



Cockermouth River-Hebron. Wild brook trout



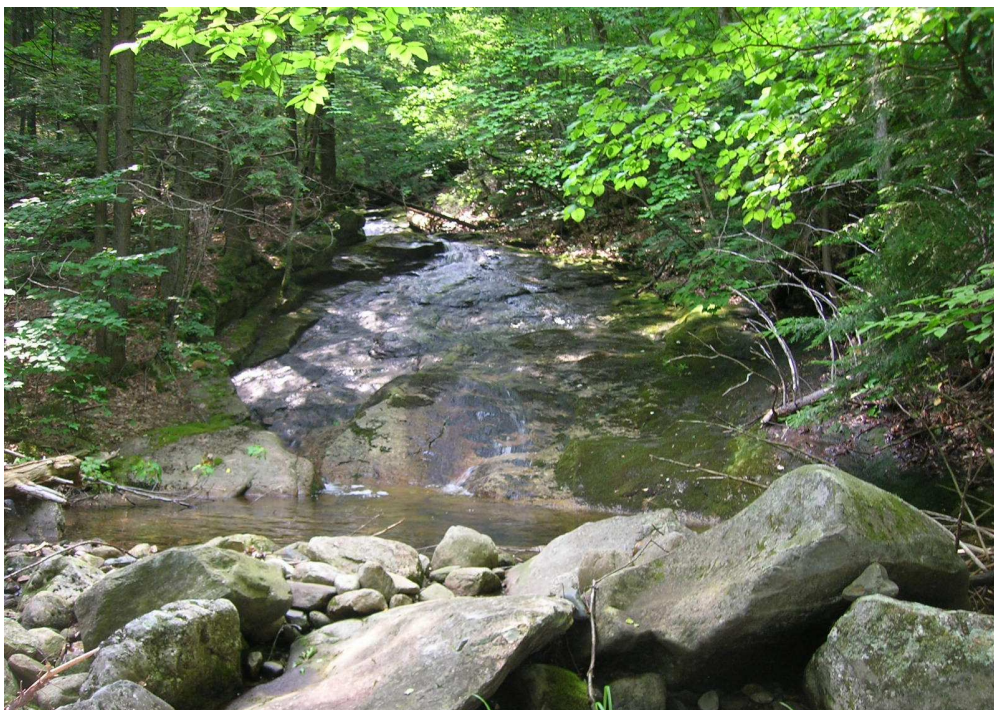
Bailey Brook-Alexandria. An example of a well forested riparian zone providing shade to a stream.



Cockermouth River-Hebron. Wild landlocked salmon juvenile



Unnamed Tributary to the Cockermouth River-Hebron. Long >50 meter chute. Wild young of the year brook trout were found in small pools within the chute. Wild brook trout were abundant above and below this area.



Headwaters of Punch Brook-Groton. Long >50 falls. Wild brook trout were abundant above and below this area.



Georges Brook-Hebron. Removal of essential riparian vegetation.



Patten Brook-Alexandria. Removal of essential riparian vegetation.