Eastern Brook Trout of Pennsylvania: Roadmap to Restoration

Salvelinus fontinalis

www.patrout.org

Objective:

This document was compiled in order to summarize the situation of the eastern brook trout of Pennsylvania, the reasons for its decline and offer guidelines for restoration. It will be circulated among the various state (PFBC, PGC, DCNR, DEP) and federal agencies and NGOs throughout the Commonwealth with an interest in preserving and protecting existing native brook trout populations and restoring, to the extent possible, those that have been lost or severely degraded by human encroachment and disturbances.

Introduction

The eastern brook trout (*Salvelinus fontinalis*) is a char, the only salmonid native to the coldwater streams of Pennsylvania and the Commonwealth's state fish.

Brook trout were molded by the Pleistocene ice ages. During glacial periods, the ice front advanced and retreated in pulses, each lasting many thousands of years. The most recent advance lasted until about 17,000 years ago.[1] During advances, ice sheets flowed south to the northern border in the center of Pennsylvania and about halfway down into the northeast and northwest corners of the Commonwealth.

As the glaciers ebbed and flowed, brook trout populations were alternately separated for thousands of years and then reunited. When reunited, they interbred and shared genes evolved during years of isolation. This alternate separating then mixing of the various populations endowed brook trout with an extremely diverse gene pool that allowed them to readily adapt to a wide variety of conditions. They could live in large and small, freestone and limestone, streams, lakes and ponds, even tiny headwaters and trickle tributaries. Their survival as a species is absolutely dependent upon this diversity and their ability to adapt to a wide range of environments.

History

Until late in the 19th century, brook trout were widespread in the Commonwealth of Pennsylvania. Some indication of the average size of brook trout taken by anglers in the late 19th and early 20th centuries comes from the creel carried at the time. It was called a 12-pounder, because, when filled with the limit of 40 trout, it weighed twelve pounds. The average brook trout in that creel would therefore have weighed about 0.30 lb. According to the PFBC Weight-Length Estimator II they would have averaged about 9 inches.[2] According to old angling literature, brook trout of 12 to 14 inches were not uncommon in large freestone streams like Kettle Creek, Sinnemahoning and Loyalsock and limestone streams. Maximum size in large freestone waters was said to be about 20 inches.[3-5]

According to old angling literature, brook trout of the large freestone streams of Pennsylvania were seasonal migrants. They typically inhabited the larger, more fertile downstream waters until early summer. As water temperatures climbed above the comfort level in these larger waters, they began moving upstream into cooler tributaries and headwaters. These movements typically coincided with periods of rain and high

water. After spawning in the fall, when winter rains again raised water levels, they moved back downstream to the main stem waters. They wintered in deep pools of the main stem, safe from anchor ice and other perils of winter, common to small freestone waters. Although brook trout of large freestone streams were not able to spend the entire year in the big waters, these movements provided an expanded forage base in the early spring, a period when most of the weight gains of brook trout living in freestone waters are accomplished, according to a 1960 study by Cooper.[6]

Such movements are typical for brook trout living in streams with highly variable flow and temperature regimes. Smith and Saunders [7] in 1958 documented movements of brook trout within and between fresh and salt water on Prince Edward Island. Only part of the population of brook trout made these movements and the percentage moving varied from year to year. Typically, moving fish were larger than those that remained in the stream for their entire lives.

Watts, Trembly and Harvey,[8] documented summer upstream and fall downstream movements in a 1942 study of Kettle Creek and its tributaries. By then larger brook trout had disappeared from the population and none over about 12 inches in length was observed. The authors attributed the loss of larger brook trout to the opening of roads into the Kettle Creek watershed.

Uncontrolled and extensive logging during the latter half of the 19th and early 20th centuries caused the initial decline of the brook trout of Pennsylvania. This was closely followed by unregulated coal mining practices which accelerated during WWII. These practices continued to be nearly unregulated until late in the 20th century. Acid mine drainage (AMD) rendered many miles of streams uninhabitable for brook trout and other aquatic life.

Widespread land development throughout the 20th century also led to, and continues to cause, a decline of the species.

European brown trout were introduced into Pennsylvania around 1886. Brown trout are better able to tolerate human disturbances than native brook trout. Brown trout are also slightly more tolerant of elevated water temperatures. Brown trout have displaced native brook trout in most of the Commonwealth's larger and more fertile streams and especially the rich limestone waters. Limestone streams of Pennsylvania are now dominated almost entirely by naturalized brown trout populations. A few limestone and limestone-influenced streams and many of the more fertile freestone streams have sympatric (mixed species) brook/brown trout populations. In waters with sympatric populations of the two species, brown trout size and biomass usually exceeds that of the brook trout.

Rainbow trout were introduced into Pennsylvania's coldwater streams at about the same time as brown trout. Rainbow trout have not become widely established in Pennsylvania's streams and therefore do not seem to present any serious or immediate threat to native brook trout in the Commonwealth. However, rainbows have become a serious threat to

southern Appalachian brook trout populations. Extensive and very costly efforts are underway there in an attempt to protect and restore remnant brook trout populations from displacement by rainbow trout.

Streams of the Appalachian Plateau are especially vulnerable to acidic deposition because they are often capped by sandstone soils which have little or no buffering capacity. Brook trout populations have been severely reduced in many miles of chronically and periodically acidified headwater streams. Some stream sections are so acidified that they are devoid of brook trout. In others, brook trout are still extant, but greatly reduced in numbers.[9]

Global Climate Change presents yet another challenge to the brook trout of Pennsylvania. Average water temperatures seem likely to increase as average global temperature rises. This will favor the expansion of brown trout, smallmouth bass and other invasive fish species into waters still dominated by native brook trout.

Taxonomic Relationships

Brook trout are closely related to lake trout (*Salvelinus namacush*). They can interbreed and the product of this cross-breeding is called splake. Lake trout were native to a few natural lakes in the northern part of Pennsylvania and Lake Erie, but were extirpated from all but Lake Erie soon after the arrival of European settlers.

Brook trout are closely related to Arctic char, bull trout, Dolly Varden and distantly related to brown trout. Brown trout and brook trout can interbreed. The product of this cross is the so-called tiger trout. They are rare in nature and sterile.

Habitat Description

Brook trout are cold water creatures. Optimum temperature for growth is 59 ºF and upper incipient lethal temperature is 78 ºF.[10] In streams where no impassable barriers exist, brook trout prefer to move upstream into shaded and cooler tributaries and headwaters during the summer as downstream water temperatures approach 70 ºF. If movement is restricted, they move into riffles and under waterfalls where the water is well aerated.

An approximately 50/50 ratio of pools to riffles is preferred. Riffles are where much of the benthic invertebrate life is generated and, when water levels are adequate, provide feeding lies. In freestone streams with highly variable flow regimes, pools are needed to provide refuge during summer when extended dry periods often reduce stream levels to trickles. Pools are also needed to provide refuge from anchor ice and ice dams during the winter.

Brook trout are more tolerant of low alkalinity than any other species of trout. They can live and reproduce in water as low as pH 5, but below that the growth rate of fry declines and death rate increases. The number of viable eggs the female can carry also declines.[11] Brook trout are often the only species of fish living and reproducing in low alkalinity, acid-impaired waters. It is not unusual to find self-sustaining populations of brook trout in waters with pH levels between 5 and 6. However, such waters are very infertile and

contain minimal aquatic life. Consequently, brook trout in low alkalinity waters are small and slender. Almost all nourishment is apparently derived from terrestrials that fall into the stream and by cannibalizing smaller brook trout. A brook trout can swallow another brook trout almost as big as itself.

Brook trout prefer lies with overhead cover for protection from avian predators but will feed in the open utilizing rocks and woody debris as cover. Feeding lies in pools are typically where the incoming current tails out, or at the tail-out of the pool. Other preferred feeding lies are pockets in riffles and runs. They lie in protected places in order to save energy, darting out to capture food as it is swept by in the current and then quickly retreat back to the protection of rocks, woody debris, undercut banks, or under tree roots. The necessity of this kind of cover cannot be overstressed.

Discussion and Current Status

Allopatric (single species) populations of brook trout are now found mostly in small, infertile freestone streams and headwaters. Because of limited resources, maximum lifespan is about 6 years and maximum length is limited to about 10 inches. As recently as 1967, brook trout in Big Spring, a small limestone stream in south-central Pennsylvania with few brown trout, achieved a maximum size of nearly 15 inches in six years (end of life).[12]

A 1952 study by Cooper,[13] in the Pigeon River, Michigan, showed that brook trout were three times as likely to be harvested by anglers as brown trout, even though legal-sized trout of both species were present in similar numbers. Electrofishing surveys indicated that brook trout in the study section seldom exceeded 10 inches and never reached the maximum size of brown trout. Brown trout exceeding 10 inches were common and individuals up to 16 inches were documented during electrofishing surveys. Angler creel surveys showed that brook trout over 10 inches were being taken in the study section on occasion, but in much lower numbers than similar-sized brown trout. Brook trout up to 16 inches were also taken on rare occasion by anglers indicating that they were capable of reaching similar size to the brown trout. Age determinations indicated that both species were growing at about the same rate

The 1952 Cooper study demonstrated that brown trout tend to be larger and more numerous than brook trout in streams with sympatric populations of the two species that are being harvested on a regular basis. He attributed this to be, at least in part, a result of the increased vulnerability of brook trout to angling pressure.

A study by Fausch and White in 1981, indicated that larger brown trout are able to exclude smaller brook trout from the most favorable positions in a stream.[14] This effect is easily observed when fishing small streams with sympatric populations of brook and brown trout. Typically the larger pools and best lies are dominated by brown trout, whereas brook trout are usually found in smaller pocket water in riffles and side channels.

Brook trout have been extirpated in most limestone streams of Pennsylvania. Some still

hold sympatric brook/brown trout populations but brook trout biomass and size tend to be much lower than those of the more dominant brown trout.

Brook trout can still approach historic large size in a few of the more fertile waters. There are a few streams in the eastern part of Pennsylvania where brook trout regularly achieve large size like that shown in Figure 1. However, wild brook trout over ten or eleven inches in length are very rare in most streams of Pennsylvania.

Figure 1. 16-inch Brook Trout Caught in an Unstocked Stream in Eastern Pennsylvania. ***Photo courtesy of Chaz Macdonald***

Although brook trout are still present in many watersheds of Pennsylvania, their presence has been much reduced, as shown in Table 1. Only 1% of the historically occupied watersheds are relatively intact (~90% occupied). Another 9% of the watersheds have brook trout present in reduced percentages (50-90% occupied) and 39% have existing but greatly reduced (<50% occupied) populations. Brook trout have been extirpated in 34% of the watersheds where they were once extant.

Table 1. Brook Trout Situation in Watersheds of Pennsylvania[15]

Brook Trout Classification	No. of Watersheds	Watersheds Occupied
Intact (~90% occupied)	16	1%
Reduced (50-90% habitat occupied)	118	9%
Greatly Reduced (<50% occupied)	507	39%
Present (qualitative data only)	5	<1%
Extirpated	449	34%
Unknown (no data)	218	17%
Total	1313	100%

The distribution of these watersheds and brook trout situation are shown in Figure 2. Regions where brook trout have been extirpated tend to be concentrated around the periphery of their current range. The areas around population centers in the southwest and southeast have been especially hard hit. The northcentral region is relatively undeveloped and current center of the best brook trout habitat of Pennsylvania. A smaller center of relatively intact waters is also present in the northeast corner.

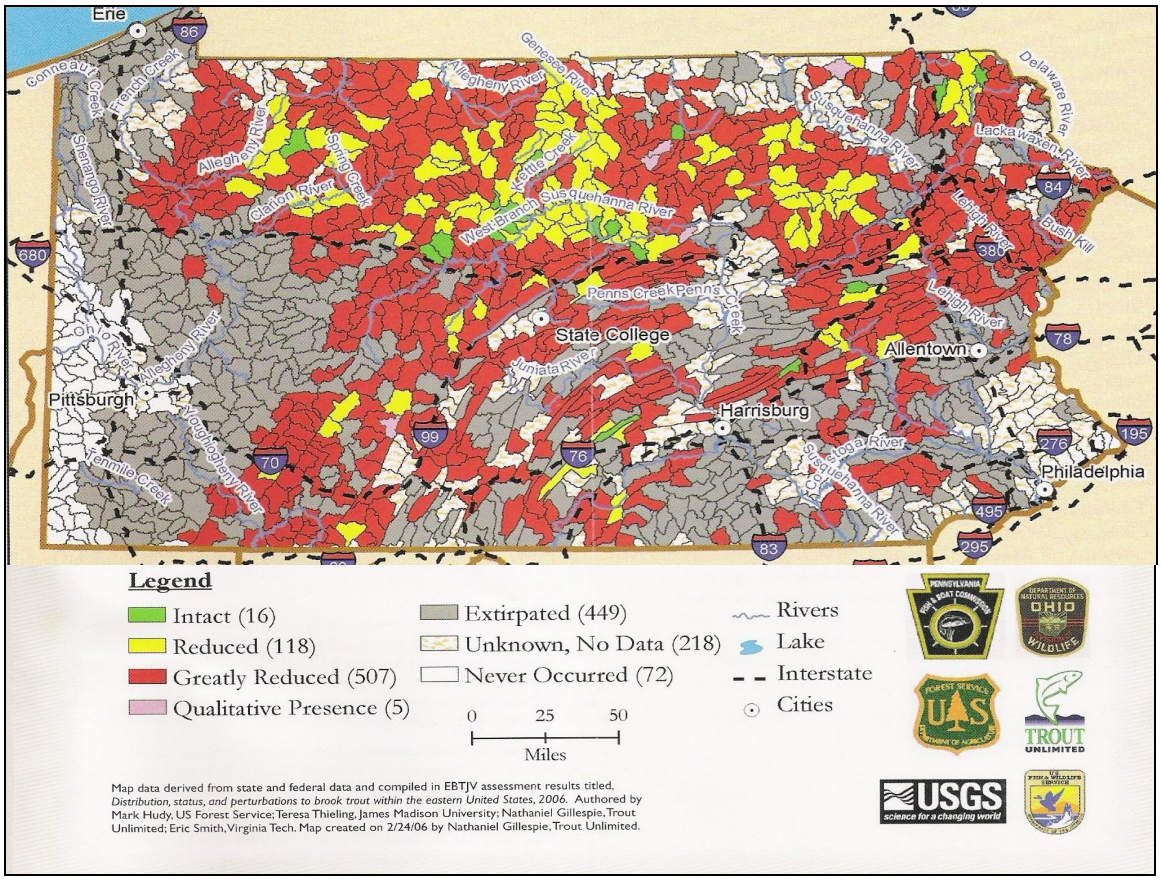

Figure 2. Distribution and Situation of Brook Trout in Pennsylvania[15]

Stocking Over Wild Brook Trout Populations

The current status of brook trout in Pennsylvania is threatened by the practice of stocking hatchery trout over viable wild brook trout populations. Although not widely recognized by the angling public, stocking can reduce the number of wild trout available to anglers.

The negative effects of stocking over wild trout populations were documented in a 1987 study by E.R. Vincent on the Madison River, Montana.[16] Vincent observed a 160% increase in wild brown trout and an 868% increase in wild rainbow trout numbers whenever stocking was halted. As a consequence of this study, Montana removed streams with viable wild trout populations from its stocking program and confined stocking of hatchery trout to lakes and ponds.

R.A. Bachman,[17] in a 1984 study of free-ranging wild brown trout in Spruce Creek, Pennsylvania, observed agonistic encounters between hatchery and wild brown trout within 20 minutes after hatchery trout were introduced into the study area. He theorizes that these agonistic encounters waste energy and decrease the amount of time spent feeding.

The effect of terminating stocking of hatchery trout on legal sized and larger wild brook trout in nine Pennsylvania streams is shown in Figure 3.

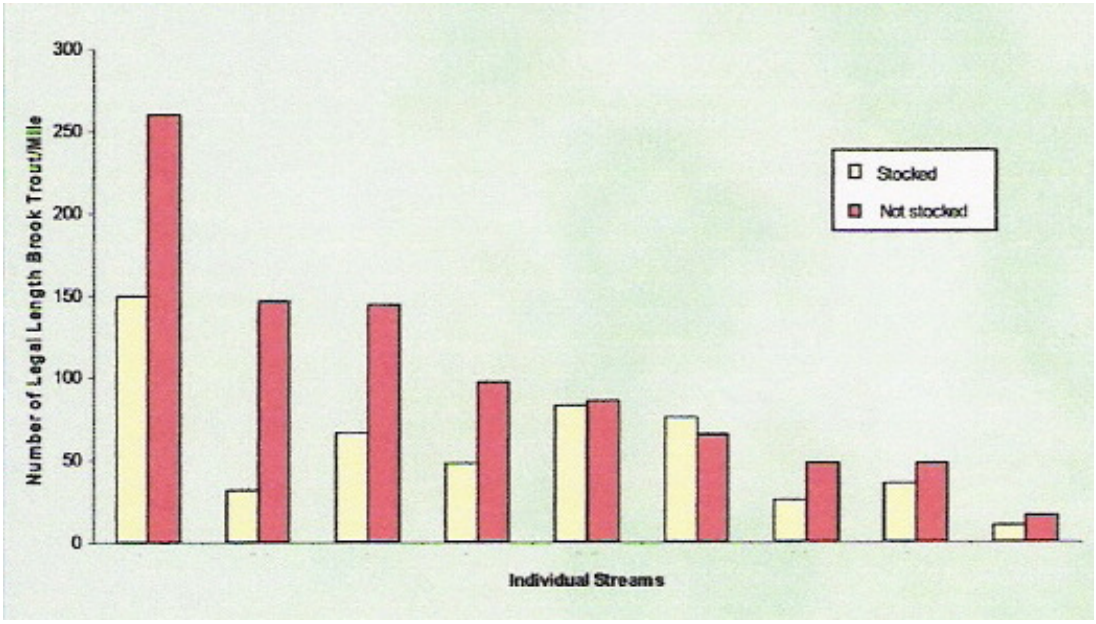

Figure 3. Legal-Size (≥7 inches) Brook Trout per Mile Before and After Cessation of Stocking in Nine Predominantly Brook Trout Streams of Pennsylvania.[18]

In all but one of the streams investigated, legal sized and larger wild brook trout numbers increased after stocking was halted. On average, the nine streams held 55 7-inch or larger wild brook trout per mile before stocking was terminated and 99 (80% more) after stocking was halted.

Hatchery brook trout are stocked by the PFBC and its associated cooperative trout nursery facilities in many streams with allopatric populations of wild brook trout. Stocking of hatchery brook trout is thought to help protect the wild brook trout populations from displacement by non-native salmonid species, namely rainbow and brown trout. However, this practice presents the possibility of interbreeding between wild and hatchery brook trout strains. Hatchery brook trout have become domesticated by more than 100 years of aquaculture and have lost many of the traits vitally needed for survival in the wild. These traits, if passed on, can reduce the viability of the wild population.[19]

The use of cooperative fish cultural facilities in Pennsylvania is wide spread. They receive fingerling trout from the PFBC and food at cost. About 20% of the approximately 5 million legal-size trout stocked every year are raised in cooperative facilities. DEP regulations regarding discharge from these facilities are minimal. In many cases, much or all of the stream's flow is withdrawn from adjacent wild brook trout streams in order to support the facility. This is especially harmful during the summer when water levels in freestone streams are reduced to trickles. Although the PFBC has strict requirements regarding where the product from these facilities can be stocked, it is widely accepted that some stock in a more or less clandestine fashion in order to provide a personal fishery for those "in the know" as to where these trout are being placed.

Although often not recognized as such, fish hatcheries are concentrated animal cultural facilities. Hatchery trout are raised in large numbers in a severely crowded environment. Crowding thousands of trout in close proximity is conducive to the spread of parasites, fungus, bacterial and viral diseases. The potential for hatchery trout to introduce pathogens and parasites into wild trout populations is well recognized. Whirling disease is, perhaps, the best example of a parasite that has been introduced into wild trout populations by the stocking of hatchery trout.

In the hatchery, these problems are typically addressed by treatment with various chemicals and antibiotics throughout the rearing cycle. However, when released into the wild, hatchery trout are potential carriers of whatever they acquired in the hatchery, even if asymptomatic. Native trout species, like brook trout, are likely to have low resistance to hatchery bred pathogens and can be very negatively affected. In a 1992 study by DeWald and Wiltzbach, 33% of the wild brook trout died from the effects of Saprolegnia fungal disease when exposed to hatchery brown trout.[20] The hatchery brown trout showed little effect of the disease.

The most obvious effect of stocking is the scale of angling attention it attracts. Often this is the reason stocking is promoted. Anglers are drawn to the stream after a visitation by the hatchery truck. However, a week or so after the stock truck has left, angler interest declines drastically. Repeated stockings are used in order to keep up interest and meet an artificial and unsustainable demand. This has created an angling culture that believes trout fishing would not exist if the state did not provide the trout. Many anglers regard hatchery trout as an entitlement. These notions have become deeply entrenched in the angling culture of Pennsylvania.

Local businesses often support stocking of nearby streams in order to draw customers. Politicians influence the allocation of hatchery trout to their districts in order to attract votes. Fisheries managers oblige these interests in order to support fishing license sales.

Another opinion often expressed by anglers is that brook trout do not get big enough to be worth fishing over and therefore stocking enhances their trout fishing experience. In actuality, stocking provides a costly, short-term fishery and seriously degrades the condition of our native trout fishery. Perhaps worst of all, massive dependence on hatchery trout has disconnected anglers from the wild brook trout angling experience. Many, perhaps most, trout anglers have little or no concept of the potential of Pennsylvania's wild brook trout streams to provide a long-term, year-round fishery at little or no cost.

Size, tackle, and creel limits have been and continue to be used in an attempt to enhance wild brook trout populations of Pennsylvania. However, no regulation change has ever resulted in such a dramatic increase in larger wild brook trout as that observed when stocking was halted.

Restoration Action Plan

Brook Trout Genetics

Currently there is very little genetic information about Pennsylvania's brook trout populations. A wide-ranging study is recommended and it should be done as soon as possible. Since the last ice age, brook trout of Pennsylvania have had some 17,000 years to adapt to the various watersheds in which they have been genetically isolated. There may be populations extant in the Commonwealth that need special attention and protection.

Additionally, because so many of our streams have been stocked with domesticated brook trout in the past – and many are still being stocked – it is imperative that the degree of introgression between native and hatchery brook trout be determined. If and when relatively uncontaminated populations of brook trout are identified, special efforts should be made to preserve and protect them.

Another concern is to what extent the genetics of Pennsylvania's brook trout populations have been altered by the fact that they have been, for the most part, confined to small, infertile streams for so long. Habitat restrictions are almost certainly changing the genetics of our native brook trout populations. Now, those individuals genetically coded to be sedentary, mature early in life, have short life spans and consequently small size, are favored. Even a hundred years ago when Pennsylvania was still relatively undeveloped, brook trout living in small infertile waters seldom reached a foot in length. In the past, however, they were able to move freely within vast watersheds and exchange genes. That is no longer possible in most cases for all the aforementioned reasons.

In streams where brook trout are able to achieve at least ten inches in length, and there are many, the use of minimum size limits to control harvest may also be selecting for small size. Life History Theory says that short life span, early sexual maturity and small ultimate size result when larger, mature individuals are selectively removed from a population. And this selection process can occur relatively quickly. A study by Reznick, et.al., [21] 1990, showed that that this selection process occurred when larger stream-dwelling guppies were selectively removed from a population. These effects happened within the range predicted: 11 years, or 30-60 generations. Other studies have shown similar effects when larger individuals are selectively removed from fish populations. This strongly suggests that minimum size limits are not the best way to control harvest.

Acid Mine Drainage

Efforts to remediate acid mine drainage (AMD) in the streams of Pennsylvania are on-going. A very large program is underway in the West Branch of the Susquehanna in order to map out all the sources of AMD entering the multitude of brook trout streams that drain into the West Branch. Efforts in the Kettle Creek drainage have been ongoing for several years and much more AMD remediation work is either underway or in the planning stages. Cooks Run, another mountain brook trout stream, is also the focus of an extensive effort to remediate some of the worst AMD in the state. These are only a couple of the streams where AMD remediation work is underway. There are many others.

But all of these efforts touch just a tiny fraction of the miles of AMD impacted streams in Pennsylvania, A lot more money and effort will be needed in the future to restore the water quality of these streams to the point where brook trout can still thrive there.

Remining in the watersheds of AMD impacted streams is probably the best and most economical way to eliminate acid mine drainage. This is typically done by strip mining abandoned drift or strip mines that had been discharging acid into trout streams for the last 50 to 100 years. Current regulations require alkaline additions to the backfill. Once re-mining is done, the land is re-vegetated and the acid drainage is gone or very greatly reduced, forever. All other AMD remediation efforts, even so-called "passive" systems require maintenance and funding for a very long time.

Acid Deposition

Many freestone streams in the Appalachian Plateau have excellent habitat, but brook trout have been extirpated or numbers and size have been reduced to a pittance by the effects of acid deposition. This is typically most severe in headwaters.

Many stream miles could be reclaimed by depositing alkaline sand onto the stream bank, by building cribs along the stream into which alkaline sand can be loaded, or by spreading it on the riparian area along the stream. Roads parallel to or crossing the stream can also be used to deliver alkaline material to streams. A large effort using several of these methods is on-going in the Mosquito Creek drainage. This is a relatively low-cost way to restore brook trout stream mileage in Pennsylvania.

However, all of these measures require repeated and long-term resources. The only real solution to acid deposition is to eliminate the discharge of SOx and NOx into the atmosphere. The Clean Air Act has helped some, but it is far from sufficient to correct the continuing damage acid deposition is doing to Pennsylvania’s forests and waters.

Development

Even minimal land development along wild brook trout streams can severly reduce or eliminate brook trout populations. Leaving riparian zones intact can help to minimize the damage. Opening of stream corridors by farming, grazing and lumbering has similar effects. These can be minimized by fencing to keep grazing animals out of the stream and leaving riparian buffers of at least 100 feet on both sides of the stream. Where riparian zones have been degraded or stripped of trees and large shrubs, native trees and shrubs should be used in restoration efforts.

Reconciling Stocking and Wild Brook Trout

Many Pennsylvania anglers have little awareness of the importance of native brook to the trout fishing heritage of Pennsylvania. A major effort is needed to educate the angling public about this heritage and the importance of preserving and protecting the species. Most importantly, a campaign to inform the angling public about the effects of stocking over wild brook trout populations needs to be mounted.

Many anglers have become accustom to fishing over hatchery fish and should be provided with places where they can practice their sport and preserve their angling tradition. This can be accomplished by redirecting hatchery trout to ponds and/or streams that do not hold viable, self-sustaining, allopatric brook trout or sympatric brook/brown trout populations. The PFBC and Trout Unlimited should work cooperatively with conservation organizations and sportsmen's clubs in order to locate marginal streams and ponds that do not hold viable wild brook trout populations but are otherwise suitable for stocking to provide angling opportunities. These should be as close as possible to whatever stream or stream sections are to be taken off the stocking schedule.

Providing acceptable alternatives is the key to making this palatable. Convincing anglers, politicians, businesses and all those who regard trout fishing as a short term or casual fishing experience provided by the state, and an entitlement, will not be easy. But the difficulty of doing so does not mean the task should not be undertaken.

Reestablishing Brook Trout Populations

Brook trout populations, when genetically isolated for many years, can develop characteristics unique to the stream system in which they have been living. A population may possess characteristics specifically suited to its home watershed. Maintaining these characteristics is important to the survival of that population and should be maintained if at all possible.

Hatchery brook trout have lost many of the characteristics needed for survival in the wild during their 100 years or so of domestication. They are poorly suited for survival in the wild and, therefore, should not be used to restore wild brook trout populations in recovering or recovered streams.

Allowing brook trout to naturally repopulate restored water is the best and cheapest way to reestablish populations. Streams that have lost populations often have self-sustaining native brook trout in tributaries or far up in unpolluted headwaters. The genetics of these trout have been molded to fit the environment of the particular watershed they inhabit. They are, therefore, best suited for survival in these particular waters. In addition, wild brook trout are mobile and extremely prolific. They can and will quickly move into and repopulate vacant stream reaches, once water quality and/or habitat have been restored.

If no connection to surviving populations exists, then brook trout from nearby and very similar watersheds can be trapped and transferred to the newly restored water. They will readily adapt to the new environment and quickly establish a viable reproducing population, especially if they are moved while young. Capturing and breeding wild brook trout stock in the hatchery is possible. However, in most cases this should not be necessary as brook trout are still plentiful and widespread enough in Pennsylvania to trap and transfer young fish from nearby streams into recovered waters. The only reason hatchery breeding may be needed would be if some unique brook trout strain is found that is near extinction and needs to be brought into the hatchery for recovery.

Competitive Species
Removing brown trout from streams where they have displaced brook trout populations either fully or in part would be, for all practical purposes, an impossible task. Additionally, considerable resistance from anglers could be expected if such a thing were even suggested.

Streams with sympatric brook/brown trout populations that are not being managed under catch-and-release regulations could be managed to allow harvest of brown trout but not brook trout. The current Brook Trout Enhancement Program is a step in that direction but, so far, has not shown any major benefits in enhancing brook trout size or numbers. It should be expanded far beyond the current few stream sections in the program. Some thought should be given to making this program applicable to all streams with sympatric brook/brown trout populations. These are often the streams with sufficient alkalinity and habitat to support superior populations of wild brook trout that are being suppressed by brown trout. Allowing selective harvesting of the non-native species would help to make up for the difference in susceptibility of the two species to angling pressure.

Actually, brook trout can hold their own and even dominate in low-alkalinity freestone streams if given the chance. Their resistance to acidity and ability to survive in low fertility streams with highly variable flow regimes (most freestones) should not be underestimated.

Acid deposition (AD) has eliminated naturalized brown trout from many streams that still hold brook trout populations. The brook trout in many of these streams have responded positively since stocking ceased. Enactment of the Clean Air Act has helped, as has the lack of attention that hatchery trout drew when the streams were still being stocked. These streams present an opportunity for restoration as allopatric brook trout waters.

AMD impacted streams with no trout of any species present similar opportunities. Unfortunately, unauthorized stocking of AD and AMD impacted waters tends to occur as soon as they are identified as again being capable of holding trout. This practice should be strongly discouraged by the PFBC.

Recovering streams should be managed as no-kill waters. This would allow time for the stream to recover naturally and remove much of the incentive to restock them with non-native trout or hatchery brook trout.

Dam Removal
The ongoing PFBC dam removal program helps to reconnect streams to tributaries and headwaters. There may be cases where leaving a dam in place would be desirable in order to block migration of brown trout or other alien fish species from invading upstream, but these would be unusual. In most cases removing dams is desirable. Brook trout living in infertile freestone streams often utilize long stream reaches in order to meet their needs for food, suitable seasonal water temperatures and living space. Although only a portion of any particular brook trout population may make these movements, they are often the larger, longer lived individuals. Restoring this ability to utilize many miles of stream to

fulfill their needs allows brook trout to live long lives and continue to grow. Continued support for the dam removal program is very important to restoration of our native brook trout.

Unknown/Unidentified Brook Trout Populations

Many unidentified small tributaries and headwaters of Pennsylvania may have relict brook trout populations that have been isolated for many years by pollution and other barriers to movement. They should be identified. Much of this can be done by anglers. The PFBC has a long list of streams in Pennsylvania with natural reproduction of trout. If any stream is known to have brook trout, but is not on this list, the PFBC should be notified of its existence. Those with a penchant for exploring out-of-the-way streams are encouraged to try to track down some of these isolated brook trout populations and identify them for addition to the PFBC natural reproduction list. Streams so identified should receive additional protection from degradation.

A Plea for Action

All parties interested in preserving our only native stream-dwelling salmonid and state fish and all the associated species that live in waters where these fish evolved are asked to participate in this endeavor. The decline of Pennsylvania's native brook trout can be blamed on many factors. Some have been more disastrous than others, and some are irreversible. In total, they are the reason that brook trout in the Commonwealth now seldom exceed 10 inches and the waters inhabited by the species have shrunk tremendously. Many of the factors that once allowed brook trout of Pennsylvania to utilize extensive stream reaches and occupy large fertile waters where they once achieved 20 inches or more have been and continue to be under attack from many quarters. Even though brook trout still swim in many miles of our unpolluted coldwater streams, the threats are real and must be addressed, otherwise this fine native game fish will continue to decline.

The Pennsylvania Council of Trout Unlimited requests that the various state agencies: Pennsylvania Fish and Boat Commission, Pennsylvania Game Commission, Department of Conservation and Natural Resources and the National Forest Service in charge of the Allegheny National Forest develop a Memorandum of Agreement that embraces the recommendations of this document.

In addition, the PA Council of Trout Unlimited asks the PFBC to establish a Brook Trout Restoration Fund by adding a small fee to the annual fishing license and some portion of monies from fines, donations and other sources to further the cause of preserving, protecting and restoring coldwater streams where brook trout can thrive in perpetuity.

List of References

1. Sevon, W.D., Fleeger, G.M. and Shepps, V.C., 1999. Pennsylvania and the Ice Age(2nd ed.). Pennsylvania Geological Survey, 4th ser., Educational Series 6, 30p http://www.dcnr.state.pa.us/topogeo/education/es6/es6.pdf

2. PFBC, Weight-Length Estimator Part II, http://www.fishandboat.com/images/pages/fishin1/weightlength2.pdf

3. Wetzel, Charles, 1962 "Brook Trout Fishing in the Kettle Creek Country." From: "100 Pennsylvania Trout Streams and How to Fish Them," Compiled and edited by Jim Hayes.

4. Lose, Charles, 1931, "The Vanishing Trout" Published by The Times Tribune Company., Altoona, PA

5. Greeley, Max with Hayes, Jim, 1980 "Potter County Trout Fishing in the Good Old Days" Pennsylvania Angler p14.

6. Cooper, Edwin L., 1960, "Growth of Wild and Hatchery Strains of Brook Trout" Journal series of the Pennsylvania Agricultural Experiment Station, No. 2506, Nov. 8, 1960.

7. Smith, M.W., & J.W. Saunders, 1958. "Movements of Brook Trout, Salvelinus fontinalis (Mitchell) Between and Within Fresh and Salt Water" Journal of the Fisheries Board of Canada, 15(6), p1403-1449.

8. Watts, R.L., G.L. Trembly and George W. Harvey, 1942, "Brook Trout in Kettle Creek and Tributaries" The Pennsylvania State College of Agriculture, Bulletin 437, Dec. 1942

9. Heard, Robin M., W. E. Sharpe, R. F. Carline and W. G. Kimmel. 1997. "Episodic Acidification and Changes in Fish Diversity in Pennsylvania Headwater Streams" Transactions of the American Fisheries Society, 126:977-984.

10. Bisson, Peter A. 1991. "The Trouts' Environs" from TROUT - Edited by Judith Stolz & Judith Schnell and published by Stackpole Books, p133

11. Karas, Nick. 1997. "Brook Trout" publ. by Lyons & Burford, New York, p291

12. Cooper, Edwin L. 1967 "Growth and Longevity of Brook Trout (Salvelinus fontinalis) in Populations Subjected to Light Exploitation." Transactions of the American Fisheries Society, Vol. 96, No. 4 Oct. 2, 1967, pp383-386.

13. Cooper, Edwin L. 1952. “Rate of Exploitation of Wild Eastern Brook Trout and Brown Trout Populations in the Pigeon River, Otsego County, Michigan” Transactions of the American Fisheries Soc., Vol. 81, pp 224-234.

14. Fausch, Kurt D, and Ray J. White. 1981. “Competition Between Brook Trout (Salvelinus fontinalis) and Brown Trout (Salmo trutta) for positions in a Michigan Stream” Can. J. Fish. Aquat. Sci. 38:1220-1227.

15. Trout Unlimited, “Eastern Brook Trout: Status and Threats” a publication for the Eastern Brook Trout Joint Venture, pp16-17

16. Vincent, E.R. 1987. “Effects of Stocking Catchable-Size Rainbow Trout on Two Wild Trout Species in the Madison River and O’Dell Creek, Montana” North American Journal of Fisheries Management 7:91-105

17. Bachman, R.A. 1984. “Foraging Behavior of Free-Ranging Wild and Hatchery Brown Trout in a Stream” Transactions of the American Fisheries Society 113:1-32

18. Presentation given by the Pennsylvania Fish and Boat Commission at the Trout Summit, Sept. 28, 2002

19. Leary, Robb F. 1991. “Why Not Stock?” from TROUT - Edited by Judith Stolz & Judith Schnell and published by Stackpole Books, pp346-350

20. DeWald, Lynn and Margaret A. Wilzbach. 1992. “Interactions between Native Brook Trout and Hatchery Brown Trout: Effects on Habitat Use, Feeding, and Growth” Transactions of the American Fisheries Society 121:287-296

21. Reznick, A..David, Heather Bryga and John A. Endler. 1990, “Experimentally Induced Life History Evolution in a Natural Population” Nature, Vol..346, 26 July, 1990. pp357-359.