WEST VIRGINIA

TROUT MANAGEMENT PLAN

2022-2031

WEST VIRGINIA DNR

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Nearly 100,000 anglers buy a trout stamp each year in West Virginia, making trout among the most popular species that anglers seek. Trout anglers are avid. In a recent survey by West Virginia University, trout anglers fish an average of 57 days per year (Andrew et al. 2020). Trout anglers travel nearly 90 minutes one-way to fish for trout. Therefore, trout anglers contribute greatly to the local economies of West Virginia.

Trout management in West Virginia consists of programs for stocked trout and wild trout. The West Virginia Division of Natural Resources (WVDNR) stocks catchable-size trout in more than 200 lakes and streams across the state. This attracts families and inexperienced anglers to try stocked trout fishing. The WVDNR stocks trout during cooler weather in streams and lakes that normally could not support trout fisheries during the summer. Therefore, stocked trout provide outstanding fishing opportunities for about eight months each year.

Wild trout are also popular with West Virginia anglers. Brook Trout are the only trout native to West Virginia, but wild populations of Rainbow Trout and Brown Trout exist in many streams. Native and wild trout can be found in most counties. WVDNR fisheries biologists study these populations to better understand trout abundance, reproduction, growth, and survival to manage and conserve these fisheries. Understanding trout ecology, genetics, and habitat are also vital to successful management programs.

To create the West Virginia Trout Management Plan (the Plan), the WVDNR sought broad public input at the beginning of the process. That input continued throughout the development of the Plan. First, WVDNR collected input from thousands of anglers at WVDNR Section Meetings, public meetings, and written comments online. Then, the WVDNR created a Stakeholder Advisory Committee (SAC) and a Technical Advisory Committee (TAC) who together developed this Plan. The roles of the SAC were to identify issues with trout fishing and management, describe why those issues are important, and develop goals to address those issues. Therefore, the SAC focused on value choices. The TAC's responsibility included formally writing the issues, values, and goals of the SAC, developing objectives and strategies to meet stakeholder goals, and writing the Plan. The first section of the Plan included a history of trout stocking in West Virginia, descriptions of the stocked trout program, the native/wild trout program, and the ecology of trout.

The SAC identified seven issue areas that guided this Plan. These seven areas guided the goals, objectives, and strategies for stocked and wild trout management.

Funding, investment and capacity

This broad issue encompasses three components of our collective ability to manage West Virginia's trout fishery. In the context of this plan, funding means the amount of money available for trout management. Investment means the decisions that we make about the programs and activities to which we direct funding. Capacity means our ability to translate funding and investment decisions into desired outcomes. These three components concern trout anglers because current funding constrains both our investment decisions and our capacity to manage stocked and wild trout fisheries in the state.

GOALS

Ensure adequate funding is available, through a variety of mechanisms, to allow for investment in programs and activities that increase recreational opportunities. Increase capacity of streams to support and sustain trout habitat and angler opportunity over a larger and more diverse area. Additionally, increase the ability of WVDNR and its partners to adequately maintain healthy trout populations in those areas.

OBJECTIVES

1. Conduct a financial evaluation of current WVDNR trout management activities by December 31, 2022.
2. Identify additional funding sources for programs and activities that will enhance recreational trout fishing opportunities by July 1, 2023.
3. Develop 25 partnerships with private landowners, local entities, municipalities, industries, conservation partners, and public groups that support long-term investments in stocked trout management or help sustain wild/native trout management by July 1, 2026.
4. Identify expenses required to enhance stocked and wild/native trout programs by December 31, 2023.
5. Develop a financial plan and balance sheet that projects operational costs to support the trout management program by December 31, 2023.

Diversifying and enhancing public fishing access

Although West Virginia has an abundance of access areas for fishing, the need for additional access is a recurring issue. However, acquiring new access is limited because of the financial constraints incurred by the purchase and maintenance of additional areas. Providing information to stakeholders on the location of approved access is also critical.

GOALS

Increase, improve, and protect public access to coldwater fisheries across the state. Provide public education on access opportunities and available facilities.

OBJECTIVES

1. Increase the number of trout stocking access points by 10% (200 additional locations) by January 1, 2026. The WVDNR currently stocks trout at approximately 2,000 different access points across the state.
2. Improve the quality of current public access points by providing facilities for families, youth anglers, and disabled anglers beginning in 2023.
3. Create partnerships with public and private entities to expand angling access and improve facilities for coldwater resources starting December 31, 2022.
4. Provide access to documents that describe the legal rights for stream access on private land by January 1, 2023.

Habitat

Healthy populations of trout require connected stream networks that feature a continuous supply of cold, clean water, and a diverse blend of habitats, including deep pools and swift flowing riffles with abundant cover. Trout populations can become compromised and potentially eliminated where habitat conditions are impaired.

There is a need for more adequate protection and restoration of coldwater habitats, including the streamside riparian buffers, overall water quality, and better watershed connectivity. Improved public awareness and education regarding the importance of healthy coldwater habitat is essential. Coldwater habitat restoration projects should be prioritized and evaluated to determine if current environmental regulations provide adequate habitat protection. Partnerships with local communities and awareness of stream habitat restoration may also promote tourism.

GOALS

Maintain or enhance existing high-quality trout habitats and restore those areas that have been degraded. Promote appropriate land use practices to protect water quality and quantity. Engage traditional and non-traditional partners in stream habitat management opportunities.

OBJECTIVES

1. Protect 25 stream segments with existing high-quality trout habitat at risk of future degradation by December 31, 2026.
2. Enhance or restore 30 miles of in-stream physical habitat by December 31, 2026.
3. Maintain 300 miles and improve an additional 50 miles of water quality to support trout populations in streams by December 31, 2026.
4. Increase connectivity by restoring fish passage at 25 locations by December 31, 2026.

Ecological health and risks

Landscape disturbances have resulted in a loss of high-quality trout habitat. Larger-scale watershed restoration efforts have additional ecosystem benefits including nutrient cycling, controlling erosion and sediment control, and reducing the impacts of climate change and other natural disasters.

Fish stocking can result in additional competition between trout species and other organisms. Increases in species competition can also occur between wild and stocked trout populations.

Fish stocking, anglers moving fish to alternate locations, and the risk of disease transfer could cause fish health concern thought the ecosystem. Information is lacking to evaluate and monitor potential disease risk in hatchery-reared and wild fish populations, and disease concerns should be taken into consideration to insure healthy fish populations.

GOALS

Better understand the variety of ecological threats to trout populations. Educate the public on the threats to increase awareness and stewardship. Improve management and conservation of trout to create sustainable fisheries and minimize adverse impacts to the aquatic ecosystem.

OBJECTIVES

1. Establish monitoring programs on ecological threats that affect water quality, habitat, and climate change across West Virginia by December 31, 2023.
2. Implement fish health monitoring programs for hatchery and wild trout by December 31, 2023.
3. Develop a program to monitor the genetic integrity of wild and stocked populations by December 31, 2023.
4. Establish a public outreach program on the ecological risks to trout populations (e.g., moving fish, water quality, habitat impairment, exotic species, etc.) by December 31, 2022.
5. Develop a database to store, analyze, and share trout data by December 31, 2024.

Diversification of stocked trout fishing opportunities

West Virginia trout anglers indicate a need for more diverse angling opportunities with an emphasis on fingerling growth for a wild trout experience. Diversified management opportunities and programs are desired to be across the calendar year and should be different for stocked versus wild/native trout. Anglers would like to see more youth programs introduced within those programs. While announced trout stockings have been the norm, it appears that some anglers want to see less notification to avoid crowded areas and trout stocking truck followers. West Virginia anglers want resource protection and habitat improvement as part of the trout program.

GOAL

Improve satisfaction of stocked trout anglers through a diversity of experiences to maintain and increase participation.

OBJECTIVES

1. Expand trout fishing opportunities beginning in 2023 by diversifying the frequency and location of trout stocking and extending the stocking season.
2. Request delayed harvest regulations through the Natural Resources Commission (to be completed by 2025) that will diversify stocked trout fishing by seasonally using catch-and-release and harvest regulations.
3. Diversify the mix of trout species stocked within each WVDNR district beginning in 2023.
4. Diversify when stockings are pre-announced and reported.

Enhancing native and wild trout fisheries

Native and wild trout provide popular fisheries throughout West Virginia. Consequently, many anglers are concerned with the status, management, and angler use of these fisheries. Resource managers and trout anglers alike need to better understand the status of wild trout populations and management options to respond to the threats they face, such as climate change, habitat reduction, acid precipitation, and over harvesting. How temperature and hydrology fluctuate because of changing climatic conditions need to be better understood in order to improve wild trout management. Additionally, aquatic habitats in many streams that support wild trout or could support them have been degraded by historical land use. Finally, in some locations excessive harvest, especially of Brook Trout, may be a factor suppressing wild trout populations.

GOALS

Enhance native and wild trout populations in West Virginia and develop deeper public connections to the resource. Improve scientific knowledge of native trout populations and their habitats.

OBJECTIVES

1. Refine and publish known native Brook Trout and wild trout distribution and status on public land as part of the online Fishing Map by March 31, 2024, and continue to refine and update annually by March 31.
2. Complete a statewide genetic assessment of native Brook Trout by December 31, 2026.
3. Restore native Brook Trout to selected stream segments within a minimum of three (3) sub-watersheds (HUC12) by December 31, 2026.
4. Assess streams across the range of wild and native trout for acid precipitation and climate change impacts beginning in 2022.
5. Implement a trout waters classification system to guide management to the "wildest" condition feasible by December 31, 2022.
6. Conduct research to determine if stocking trout reduces the number and biomass of trout populations in three streams by December 31, 2026.
7. Propose a minimum of four (4) native or wild trout waters for gear and harvest regulations (e.g., creel limit, tackle, length restriction, etc.) by December 31, 2024.

Education, outreach and communication

The WVDNR utilizes a variety of approaches to educate the public about trout fishing and management. Many of these programs are designed for youth and occur in schools. However, other programs that can educate individuals about trout fishing, conservation, and management are needed to reach a broader audience and increase interest and participation.

The WVDNR partners with other agencies, communities, and schools to conduct outreach events to introduce people to fishing. However, participation in some outreach programs has declined. Additionally, the average age of a trout angler is 57 and more than 90% are male. Therefore, existing education and outreach programs may be insufficient at diversifying the individuals who trout fish.

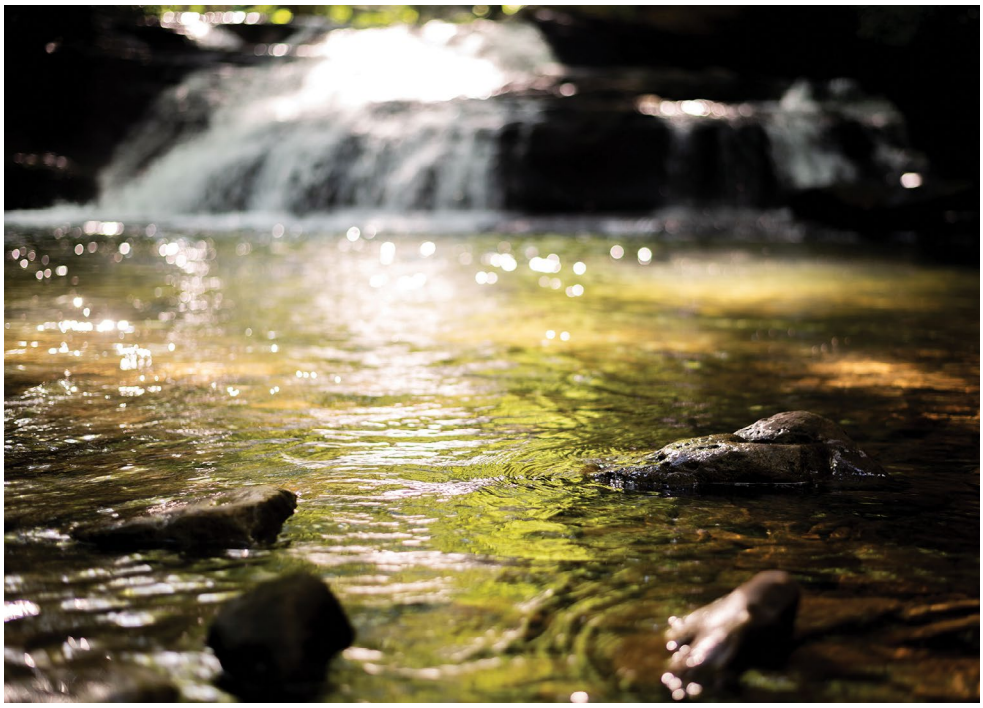
The future of trout management in West Virginia relies on strong two-way communication between WVDNR and the public. Individuals can communicate with WVDNR staff regarding trout fishing and management by attending public meetings or contacting staff directly. Conversely, WVDNR relies on the agency website and social media platforms to relay information regarding trout fishing and management. Website and social media users would like to see information expanded. However, stakeholders that do not utilize technology have difficulty finding and sharing information about trout fishing.

GOALS

Cultivate a broad public connection to coldwater fisheries resources and conservation issues and efforts. Support and educate existing and future anglers on trout fishing opportunities and retain those that already participate.

OBJECTIVES

1. Increase youth and young adult participation in trout fishing by 10% by December 31, 2026.
2. Increase participation of women in trout fishing by 10% by December 31, 2026.
3. Increase participation of racial and ethnic minorities in trout fishing by 10% by December 31, 2026.
4. Increase trout-related content on DNR managed media platforms by 20% by December 31, 2026.
5. Conduct a trout-related survey by December 31, 2026, and at least one every 5 years thereafter to gauge and evaluate public interest in trout management.
6. Increase direct-engagement youth educational opportunities for trout and coldwater conservation by 15%.
7. Increase adult outreach opportunities for trout and coldwater conservation by 10%.
8. Develop and implement four (4) trout fishing promotions by December 31, 2026.



Over the next 10 years, the WVDNR, along with other resource agencies and partner organizations, will work towards improving trout fisheries and trout fishing based on the stakeholder input found in this Plan.

ACKNOWLEDGEMENTS

WEST VIRGINIA
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The West Virginia Division of Natural Resources (WVDNR) thanks the thousands of individuals who attended public meetings and provided valuable insight. These public comments provided the necessary information for the Stakeholder Advisory Committee (SAC) to identify issues and goals for the West Virginia Trout Management Plan (the Plan). The SAC demonstrated a high level of commitment to the planning process, utilized information from all sources, and worked unselfishly and cordially to complete the Plan.

The Technical Advisory Committee (TAC) reviewed all scientific and technical information that went into the Plan. This Plan represents an integration of extensive public input and sound scientific principles that will guide trout management for 10 years. The TAC thanks former WVDNR biologist Clifford Brown for his careful review.

GLOSSARY

Acid Mine Drainage (AMD) – waters polluted by underground and surface mining due to the reaction of unweathered minerals reacting with a water source, often creating sulfuric acid of varying strength and toxicity. The resultant acidic water further dissolves other minerals, many of which are toxic to aquatic life.

Acidification – the process of surface waters increasing in acidity from either Acid Mine Drainage or Acidic Precipitation to the point where surface minerals and waters can no longer buffer the pH in a suitable range for desirable aquatic life.

Allopatric – the isolation of species or populations to such a degree that dispersal and gene flow is negligible, resulting in evolutionarily independent populations. In this text, when we describe allopatric Brook Trout populations, it is intended to mean that these populations have no competition from trout other than those that are within their same population.

Aquatic Organism Passage (AOP) – the all-encompassing term used to describe adequate corridors for up- or down-stream migration of stream-dwelling organisms that cannot leave the wetted margins of a waterbody.

Basin – 1. A tract of land that is drained from its margins to a single exit point by a river or stream and its tributaries. Equivalent to a watershed. 2. In the USGS Hydrologic Unit Code (HUC) system, "basin" is a 3rd level, or 6-digit (HUC6) unit, of roughly 10,596 square miles on average.

Best Management Practices (BMP) – those practices applied by agriculture and forestry producers to reduce pollutants and keep them from reaching surface waters and streams.

Big Cut, The – a period describing roughly 50 years from 1870 to 1920 when over 30 billion board feet of lumber were cut in West Virginia. Over 20 billion board feet were cut in the 33 years between 1879 and 1912, with the peak production year of 1909. This increase in productivity was driven by technology: increasing steam power, railroads, mill automation, and the bandsaw mill.

Catchment – a catchment is equivalent to basin (1). In the context of this plan, it refers to the statistically derived basin of the smallest discernible stream segments, dependent on the scale of data from which a stream network is described.

Catch-and-Release (C&R) – popular regulation tool of managers and a practice by anglers where fish are caught simply for sport and promptly released back to the water from which they were caught.

Channel Incision – an in-stream feedback process whereby streambank and channel substrate erosion is greater than deposition, leading to widened and deepened stream channels that cannot empty their sediment load into the floodplain during normal bankfull flow events. Energy from floodwaters remains within the stream channel, further increasing the erosive capacity of the stream flows.

Connectivity – the state or extent of having an unbroken network of tributaries making up a stream system that are freely accessible to a given target species or suite of organisms.

Conservation Portfolio (from Trout Unlimited) – an inventory of the elements of diversity within a species' range to identify the essential and missing elements, which, if conserved, may help ensure a species' persistence. A diverse Conservation Portfolio for native trout spreads the risk of loss across a variety of habitats and populations by including at least some proportion of the life history, habitat, and genetic diversity that has allowed these fishes to succeed and persist over time despite disturbances and changes to their environment.

Conservation Regulations – those regulations implemented by an agency (in this case the WVDNR or its precursors) to ensure some level of protection, typically by reducing or eliminating harvest, for a population.

Delayed Harvest (DH) – a regulation implemented to provide recreation C&R angling during periods when the likelihood of fish survival is highest, then removing restrictive harvest when conditions begin to become inhospitable (in WV for trout, it is water temperature) for survival. This allows for an extended recreational fishing season, allowing many more fish a chance to acclimatize to a stream existence and provides a more diverse and desirable (for some) angling experience.

Density-Dependent – a regulating process in population ecology in which a population expands as long as resources and habitat supply surpasses the demand of the number of individuals (or total population biomass) in the population. Continued expansion is untenable in a closed system, however, and as resources become scarce and available habitats are filled, the population may undergo a contraction, either from emigration, increased death rates, decreased birth rates, or decreased growth rates. In a stable system, this oscillation of growth and contraction will hover around what is deemed the carrying capacity of the ecosystem.

Dingell-Johnson Act (D-J) – The Federal Aid in Sport Fish Restoration Act of 1950 that allowed for the establishment and collection of an excise tax on all fishing-related sporting equipment to be returned to the states specifically for management and improvement of fisheries. This is the financial source for most fishery management activities in all states, including West Virginia.

GLOSSARY

Dissolved Oxygen (DO) – the amount of free oxygen that can be assimilated into water for aquatic organisms to utilize for respiration. As water temperature increases, the capacity for water to absorb additional oxygen from the atmosphere is reduced. Excess organic pollution increases demand for oxygen (decomposition processes), sometimes to the point at which desirable aquatic life is harmed or killed.

Eastern Brook Trout Joint Venture (EBTJV) – a partnership between state and federal agencies, regional and local governments, businesses, conservation organizations, academia, scientific societies, and private citizens working toward protecting, restoring, and enhancing Brook Trout populations and their habitats across their native range.

Extirpation – the extinction of a species at some arbitrary localized scale, where the species continues to exist elsewhere across its range.

Fly Fishing Only (FFO) – a regulation implemented to provide recreational angling limiting tackle to traditional fly-casting gear and artificial flies of fur, feather, or synthetic materials. In West Virginia, only some very special waters are fly fishing only, typically to limit angling pressure on a limited or sensitive resource.

General Regulations – those regulations approved by the West Virginia Natural Resources Commission as the least restrictive to allow for consumptive harvest and recreational angling and still maintain sustainable or desirable natural resource conditions.

Habitat – a place where an organism lives. Components of stream habitat include water quality and quantity, substrate, in-stream and overhead shelter or cover, and spawning areas. Riffles, runs, pools, and glides are the features that contribute to trout stream habitat.

Heritage Strain – those populations (in this case native Brook Trout) that retain the natural characteristics and genetic components of their progenitors appropriate to their local watershed without added genetic components (e.g., stocking), to the understanding of the best contemporary scientific thought.

Hydrologic Unit Code (HUCX) – The nested hierarchical coding system for streams networks and watersheds of the United States Geologic Survey.

Keystone Species – a species on which others in an ecosystem largely depend, such that if it were removed the ecosystem would change drastically.

Legislative Rules – The enforceable rules of the State of West Virginia as written in legal code and adopted in concurrence with the intentions of the elected body of Delegates and Senators of the West Virginia legislature.

Limestone Sand – a natural limestone aggregate material crushed from quarried limestone rock and sieved to a desired composition. In the context of this document, it is used as a material applied into waterways for the remediation of acidic deposition, primarily acid precipitation. Ideally, it should be of a very high (>90%) Calcium Carbonate composition and no more than 40% powder and no particles greater than 4.76 mm (0.1875 inches).

Limiting Factor, Population – an internal or external action upon a population that determines its presence, persistence, or absence. Some limiting environmental factors to stream fishes may include extended drought, oxygen depletion, extreme acidity, excess fine sediment, or extreme temperatures.

Native – originating, occurring, living, and growing naturally in a particular place or environment, especially in an unadulterated form.

Naturalized – something (Brown and Rainbow Trout populations in this instance) that has become established and living a self-determined and self-sustaining existence in a place that it did not originate.

Pre-settlement – the state of place in its natural existence before the arrival of European explorers and settlers. In West Virginia, many areas were not settled until well after the Revolutionary War, but pre-settlement typically refers to pre-1750 conditions.

Redd – the spawning ground or manicured nest of various fishes.

Regulating Factor, Population – those processes that affect birth and death rates (including immigration and emigration) of a population. Competition and predation (biotic) are density-dependent regulating factors, while severe weather events, natural disasters, and pollution (abiotic) are density-independent factors.

Resilient – the ability of an organism or population to return to an equilibrium existence quickly after some external perturbation.

Riparian – that interface area of land adjacent to a river or stream. Streambanks and floodplains are easily recognized riparian areas, but any land area of unique soils and vegetation that are strongly influenced by the presence of water is part of the riparian zone.

Salmonidae – the taxonomic Family name of the Trouts and Salmons. It includes the Brook, Brown, and Rainbow Trout plus the Atlantic and Pacific salmons, chars, freshwater whitefishes, and graylings.

Special Regulations – those regulations approved by the West Virginia Natural Resources Commission that deviate from General Regulations to provide added protections to special species or places or to create alternative angling opportunities. These regulations may include zero- or reduced-creel limits, size restrictions, tackle restrictions, or angler age-specific rules.

State Wildlife Action Plan (SWAP) – a periodic assessment of Species of Greatest Conservation Need serving as a blueprint for conserving the nation's fish and wildlife and preventing additional endangered species.

Stream Capture – a phenomenon that occurs when a stream or river drainage is breached at the boundary with an adjacent watershed and diverted from its own bed and changes flow direction into the bed of a neighboring stream. The headward erosion of one stream valley upward into another is one of the most common means of stream capture.

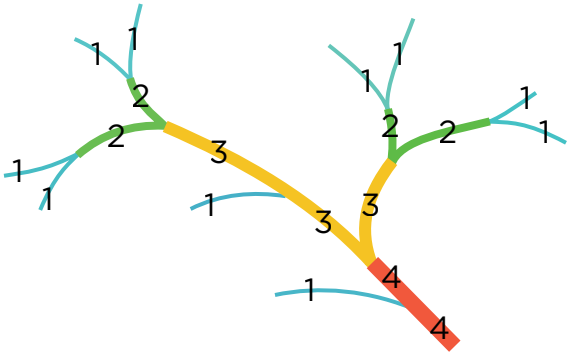
Stream Segment – any portion of a stream network that has only a single input point and a single output point. Any map of streams and the identification of the stream segments is dependent on the scale and resolution of the data represented.

Subbasin – the hierarchical subunits of a basin. In the USGS Hydrologic Unit Code (HUC) system, "subbasin" is a 4th level, or 8-digit (HUC8) unit, of roughly 828 square miles on average in West Virginia.

Subwatershed – the hierarchical subunits of a watershed. In the USGS Hydrologic Unit Code (HUC) system, "subbasin" is a 6th level, or 12-digit (HUC12) unit, of roughly 36 square miles on average in West Virginia.

Sympatric – a condition in which two related species or populations exist within the same geographic area with overlap and frequently encounter one another, but do not interbreed.

Third Order Connectivity (Stream Order) – a level of stream connectivity that virtually ensures a stable and resilient population of native Brook Trout may persist indefinitely if habitat and temperature are appropriate. Stream order (Strahler) is a hierarchical numbering of streams, which the smallest and uppermost streams are 1st order. As two streams of equal order merge, the resulting stream is given the next higher number. If two different stream orders merge, the smaller stream is assimilated into that with the higher number.



By Kilom691 - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=15757078

Translocate – the action of moving organisms (in this case native Brook Trout) from an area where they are abundant into a receiving stream where they are low in abundance or extirpated. Several translocations may be necessary to establish a resilient population.

Trout Waters – those rivers, streams, or stream networks in West Virginia that harbor trout at some point through the year. Wild trout waters imply that the stream has adequate habitat for trout to survive year-round and eventually complete its life cycle.

Watershed – 1. A tract of land that is drained from its margins to a single exit point by a river or stream and all of its tributaries. Equivalent to a basin. 2. In the USGS Hydrologic Unit Code (HUC) system, "watershed" is a 5th level, or 10-digit (HUC10) unit, of roughly 162 square miles on average.

Wild – a natural state of production and growth without human aid or care.

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The West Virginia Division of Natural Resources (WVDNR) has developed the 2022-2031 Trout Management Plan to provide goals and objectives in an effort to manage a vibrant and diverse trout program. Approximately 100,000 anglers fish for trout annually throughout West Virginia. In a recent survey by West Virginia University, trout anglers fish an average of 57 days per year (Andrew et al. 2020) and travel nearly 90 minutes one-way to fish for trout. Through the purchase of licenses and stamps, equipment and supplies, and travel related costs, trout anglers contribute greatly to the local economies of West Virginia.

Trout management in West Virginia consists of programs for stocked trout and wild trout. The WVDNR stocks catchable-size trout in more than 200 lakes and streams across the state. Anglers enjoy fishing for stocked trout because of the high catch rates these fisheries provide. This attracts families and inexperienced anglers to try stocked trout fishing. Additionally, the WVDNR stocks trout during cooler weather in streams and lakes that normally could not support trout fisheries during the summer, providing outstanding fishing opportunities for about 8 months each year.

Wild trout are also popular with West Virginia anglers. Brook Trout are the only trout native to West Virginia, but wild populations of Rainbow Trout and Brown Trout exist in many streams. Native and wild trout can be found in most counties. WVDNR fisheries biologists study these populations to better understand trout abundance, reproduction, growth, and survival to manage and conserve these fisheries. Understanding trout ecology, genetics, and habitat are also vital to successful management programs.

What is the West Virginia Trout Management Plan?

The West Virginia Trout Management Plan is a collaboration between the WVDNR and the stakeholders who enjoy the states abundant trout resources. The WVDNR utilized a variety of public engagement tools, received comments from thousands of individuals, and created a Stakeholder Advisory Committee to help inform the Plan. The WVDNR also partnered with other state and federal agencies to develop this Plan. While the primary purpose of the Plan is to identify the goals for trout management and detail the strategies to meet those goals, it provides readers so much more. First, the Plan summarizes the rich history of trout management in West Virginia. It also serves as an educational source allowing readers to understand more about each trout species, trout ecology, and habitat. Finally, since the plan looks forward to the next 10 years of management, it also identifies the various threats facing trout populations.

How was the plan developed?

The WVDNR focused on increasing and diversifying public input to develop the West Virginia Trout Management Plan. Fisheries staff asked the public to respond on the agency web page to the following questions:

- Why do you fish for trout in West Virginia?
- What do you like about trout fishing in West Virginia?
- What do you dislike about trout fishing in West Virginia?

The WVDNR received more than 7,500 comments to these questions online and at Section Meetings. Fisheries staff also hosted 6 public meetings in October 2019 to share information on the planning process and solicit input. Finally, West Virginia University conducted a survey to assess trout anglers' attitudes and opinions. Finally, the WVDNR created a Stakeholder Advisory Committee (SAC). This group of 11 individuals from across the state represented the diverse interests related to trout fishing. For this Plan, the SAC detailed seven issue areas to focus on and eventually developed goals for each area.

The WVDNR also created a Technical Advisory Committee (TAC). This group consisted of WVDNR staff as well as biologists with the United States Forest Service, the United States Fish and Wildlife Service, and the West Virginia Department of Environmental Protection. Using the information from the SAC, the TAC wrote the plan and most importantly developed the objectives and strategies to meet stakeholder goals.

Interim Changes to the Plan

Public opinions and values should not change drastically during the life of the plan. However, the WVDNR recognizes the importance of being adaptive and flexible to potential changes. Should objectives and strategies change, the WVDNR will submit proposed changes to the SAC for review before implementing changes. If changes are made, an updated plan will be posted on the WVDNR web site and social media pages.

WV STATE RECORDS BROOK TROUT

Length: 23.5 inches
(4.78 pounds, Lost River, Jack E. Foltz, 1981)

Weight: 7.64 pounds
(22.25 inches, Shavers Fork, Gary M. Chapman, 2004)

Trout illustrations on pages 2-6 by Joe Tomelleri.

Brook Trout

Brook Trout *(Salvelinus fontinalis)* is the only trout species native to West Virginia. Brook Trout are in the Char family, like Lake Trout *(S. namaycush)*, Arctic Char *(S. alpinus)*, and Dolly Varden *(S. malmus)*. The most easily identified features that separate Brook Trout from other trout species in the state are the wormlike pattern across the back and the presence of light spots on a dark background. Moving from the back to the sides, light tannish-yellow vermiculation gives way to light spots of the same color, both appearing over a dark greenish-olive background. Interspersed among the yellow spots along the mid-lower sides are light blue halos, which surround vibrant hot-pink spots. Brook Trout have a more squared-off tail, with only a slight indentation, which differs from the deeper notch of the tail of Rainbow Trout. Brook Trout have tri-colored bottom fins (pectoral, pelvic, and anal); the outer edge of these fins has a white margin and gives way to black, and then reddish pink. Similarly, the belly of vibrant male Brook Trout will be creamy white along the bottom, but give way to dark gray or black, then to oranges and reds. Male Brook Trout colors are much more vibrant in the fall months of October and November when spawning is in full swing.

Brook Trout are omnivores and can often be found eating a variety of animals, including aquatic and terrestrial insects, small mammals, crayfish, and fish. This is a beneficial foraging strategy due to the lower productivity of small, cold streams that this species now thrives in. Larger Brook Trout in larger and more productive coldwater streams also feed on a wide range of diet items but are more selective and tend to feed on larger food organisms.

Brook Trout require lower stream temperature than Brown Trout *(Salmo trutta)* or Rainbow Trout *(Oncorhynchus mykiss)*. Signs of population impacts are commonly reported once stream temperatures reach 68 - 70°F.

The maximum size of Brook Trout that can be caught in West Virginia waters depends greatly on whether wild or stocked fish are targeted. The West Virginia state length record Brook Trout measured 23.5 inches (4.78 pounds, Lost River, Jack E. Foltz, 1981) and the weight record was 7.64 pounds (22.25 inches, Shavers Fork, Gary M. Chapman, 2004). However, wild Brook Trout that reach 12 inches are considered special by many anglers that target them in the small streams to which they are typically confined.

Brown Trout

Brown Trout are closely related to Atlantic Salmon *(Salmo salar)* and are native to Europe and smaller portions of Asia and Africa. Current West Virginia hatchery stock is likely derived from German or Scottish populations. Brown Trout have been stocked throughout the United States and have become naturalized in several coldwater systems nationwide. Due to their ability to obtain large sizes, feed on larger prey, and ability to survive slightly warmer waters, Brown Trout have been observed to compete with Brook Trout and other trout species in larger coldwater systems with typically higher water temperatures.

The background color of Brown Trout is a light golden-brown. They possess dark spots on this light background. Most lateral spots are black, although a smaller number will be crimson red along the lower sides. Like Brook Trout, Brown Trout have a rather "squared" tail, with little indentation between the upper and lower lobes. Although Brown Trout color patterns can vary a great deal, many will have a white stripe on the leading edge of anal and pelvic fins, followed by a black stripe, and yellow brown throughout the remainder of the fins. As with Brook Trout, Brown Trout breeding colors are much more vibrant in the fall months of October and November when spawning is in full swing. Spawning can occur later into the year than what is typically expected with Brook Trout and can last into the month of December. Longer spans of observed spawning activity in West Virginia may be due to the variability in source population tendencies.

Brown Trout are omnivores and have a diet similar to Brook Trout. However, Brown Trout switch to feeding on larger prey, particularly fish and crayfish, as lengths of approximately 10–12 inches. Their foraging strategy, longer life span, and higher water temperature tolerance benefit Brown Trout, allowing them to naturally grow to longer than 21 inches in several larger, coldwater streams in West Virginia.

Brown Trout have a higher tolerance to increased stream temperatures than Brook or Rainbow Trout. Documentation of population impacts are not typically reported below 72°F.

The maximum size of wild Brown Trout is dependent on the size and productivity of streams whose temperatures remain below approximately 75°F. The WVDNR also stocks large Brown Trout. The West Virginia state record for length and weight was a 32-inch, 16-pound stocked fish (South Branch of the Potomac River, Paul Barker, 1968).

WV STATE RECORDS BROWN TROUT

Length and weight:
32 inches, 16 pounds
(South Branch of the Potomac River, Paul Barker, 1968)

WV STATE RECORDS TIGER TROUT

Length and weight:
28.7 inches, 10.65 pounds (Krodel Lake, Mike Connolly, 2011)

Tiger Trout

Although Brook and Brown trout belong to different genera and have a different number of chromosomes, hybridization can occur. The resulting cross between a Brown Trout female and a Brook Trout male is referred to as a Tiger Trout *(Salmo trutta x Salvelinus fontinalis)*. Tiger Trout are not able to reproduce (sterile) and rarely occur in nature, even when wild populations of Brook and Brown Trout are present in the same habitats.

Tiger Trout have characteristics from their parent species. The bellies and fins of this hybrid can take on a variety of reds, oranges, yellows, or creams, owing to the variability that exists within the parent species. It is common, like the parent species, to have white leading edges of the pectoral, pelvic and/or anal fins. However, unlike the parent species, Tiger Trout will always show more whirled line patterns along their sides. The consistent pattern of light spots (Brook Trout) or dark spots (Brown Trout) will appear blurred into wormlike appearance. Older males will often take on a deep, crimson red color to their lower sides and fins.

Tiger Trout are omnivorous and aggressive feeders and are thought to share the same general diet preferences and temperature tolerance as Brown Trout. The West Virginia state record Tiger Trout measured 28.7 inches in total length and weighed 10.65 pounds (Krodel Lake, Mike Connolly, 2011).

Rainbow Trout

Rainbow Trout are native to the western United States and Canada, a small portion of the west coast of Mexico, and a portion of the East Coast of Russia where the Aleutian Islands of Alaska extends habitat across the Bering Sea. Rainbow Trout are closely related to Pacific Salmon species. Rainbow Trout are a non-native species to West Virginia, but wild populations have been documented in the Mountain State.

Rainbow Trout possess black spots on a lighter background — ranging from silver to olive green and will have black spots throughout the tail fin. More vibrant specimens will sometimes have white tips on the anal and pelvic fins. Cheeks and gill covers (operculum) will have rosy coloration that continues along the body as a lateral stripe.

Although Rainbow Trout spawn in the spring throughout their native range, wild populations in West Virginia have been observed spawning from September through early spring months. Hatchery culture practices have selected for males and females that become reproductively ripe in late August and September, which allows production of catchable Rainbow Trout at the same time as Brown and Brook trout. This wide spawning timeframe is undoubtedly due to the influence of the behavioral influences resulting from the blending of wild and hatchery cultured fish.

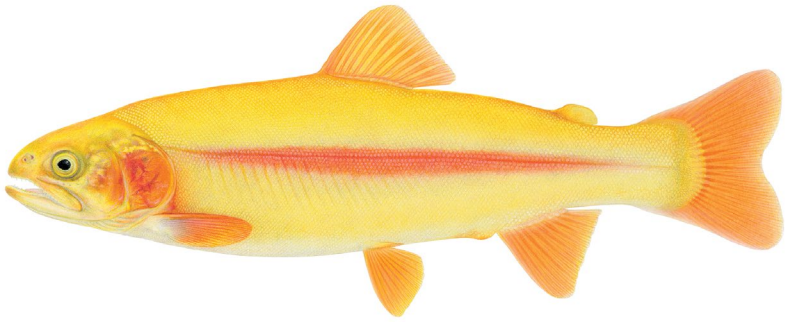
Diet studies of Rainbow Trout reflect a greater preference of smaller invertebrates (aquatic and terrestrial insects, small crustaceans) than do Brook and Brown trout. However, Rainbow Trout will still occasionally consume larger prey types (fish, crayfish).

Rainbow Trout, like Brook Trout, tend to prefer lower water temperatures (60°F). However, like Brown Trout, Rainbow Trout can tolerate water temperatures greater than 60°F.

Size ranges of wild Rainbow Trout in West Virginia are dependent upon the size and productivity of coldwater streams that they inhabit. It is not uncommon for Rainbow Trout to stunt in size due to high densities in smaller spring streams, where maximum lengths may not exceed 10 inches. In larger spring-dominated streams with larger pool habitats, Rainbow Trout may be expected to exceed 14–18 inches in length. The West Virginia state record Rainbow Trout was caught from a Berkeley County pond, measuring 33.11 inches in length and weighing 19.40 pounds (Eric Files, Sr., 2014).

WV STATE RECORDS RAINBOW TROUT

Length and weight:
33.11 inches, 19.40 pounds (Berkeley County pond , Eric Files, Sr., 2014)



WV STATE RECORDS GOLDEN TROUT

Length: 27.5 inches
(8.63 pounds, Stonecoal Lake, Gerald Estep, 1987)

Weight: 9.31 pounds
(26.4 inches, Brush Fork Lake, Danny Crider, 1998)

Golden Rainbow Trout

Golden Rainbow Trout are simply a color variant of the Rainbow Trout. The Golden Rainbow Trout's history began in the fall of 1949 when the Petersburg State Trout Hatchery in Grant County, West Virginia, received 10,000 Rainbow Trout fry from a California strain as a gift from the White Sulphur Springs Federal Hatchery. Less than 300 survived, but those fish were bred over the years to create a brood stock that went on to produce a single embryo that started the golden strain. The first Golden Rainbow, known as "Little Camouflage," was a result of this work. The Golden Rainbow Trout was introduced to the public in 1963 as part of West Virginia's Centennial celebration. Golden Rainbow Trout are not albino, nor are they to be confused with the true Golden Trout in the Western United States. Breeding male and female individuals with this prized appearance led to the development of current Golden Rainbow Trout strains that are now stocked for interested anglers across the United States. The appearance of Golden Rainbow Trout is unmistakable. Individuals are bright yellow throughout and have the same rosy/red coloration of the cheeks, operculum, and mid-lateral stripe of Rainbow Trout.

Golden Rainbow Trout have the same diet preferences and temperature needs of Rainbow Trout. The West Virginia state record Golden Trout for length measured 27.5 inches (8.63 pounds, Stonecoal Lake, Gerald Estep, 1987). The state record Golden Trout for weight is 9.31 pounds (26.4 inches, Brush Fork Lake, Danny Crider, 1998).

WV TROUT STREAM CLASSIFICATION

Because each trout stream and fishery in West Virginia presents a unique opportunity and challenge for conservation and management, it is impossible for managers to optimally manage each situation, nor is it realistic of anglers to expect such detailed management. Categorization or classification of similar stream and fishery types and applying management schemes across these categories allows managers to conserve valuable resources and provide the best opportunities to the anglers seeking their own form of trout fishing satisfaction. Past categorization efforts have ranged from overly simplistic to long-term, data-driven quality assessments.

A fisheries management plan for 1975 included no mention of any means of categorizing the trout streams of West Virginia. A single sentence mentioned the amount of stream miles and acreage of native Brook Trout waters available to anglers. The balance of the document discussed objectives and strategies for increasing trout supply to waters and use of the fisheries by anglers.

In the 1985 – 1995 Long Range Comprehensive Sport Fisheries Plan (Supplementary Material Appendix 2), a section for the trout program was introduced with the statement "Trout and trout water management in West Virginia falls into two basic categories, catchable ("put and take") waters and wild trout waters." Each of these categories was considered a "sub-program" and discussed independently within the plan. The goal of both catchable and wild trout categories was to increase supply of resource to anglers and to increase use of the resource by anglers. Quantitative objectives addressing the supply and use were stated, along with problems to achieving the objectives and the strategies to be employed to overcome these problems.

By 1990, a newer plan (Supplementary Material Appendix 3) had been developed, categorizing coldwater fisheries into five basic groups each of which was to be treated with a different management philosophy. The categories represented the spectrum from wild trout management to stocked catchable trout management (Table 1). The intent of this scheme was to address the diversity of desired angling experiences, offering something to everyone in West Virginia's trout program. The stated goal of this plan was threefold: protect and improve the coldwater fisheries resources and habitat, increase coldwater-fishing opportunities, and increase the number of coldwater anglers. Objectives, albeit without quantitative measures, and strategies for achievement of objectives were outlined and enumerated.

These five categories had been part of a working plan since mid-1975, when all the District Fishery Biologists under the leadership of the Coldwater Fisheries Biologist implemented the Trout Stream Classification project. As stated in the final Federal Aid Report (Supplementary Material Appendix 4) of the first five-year segment (1975–1980) the Job Objective (project goal) was "to rate West Virginia's trout streams in a trout stream classification system and to use these classifications for evaluating present and developing future trout management programs and policies". The quantitative assignment of these waters (Table 2) based on the data did not necessarily align with the management descriptions in the plan. Rather it was an assessment of the habitat and the suitability of those habitats to provide a continuum of trout fishing opportunities.

The effort in the Trout Stream Classification project yielded very good and necessary data, but a more diverse and ecological-driven classification to trout fisheries will better serve the needs of this new plan and trout management well into the future. Conservation of native Brook Trout across their range has risen in priority, and West Virginia bears a large portion of responsibility for the stewardship of the species within the Mid-Atlantic region. Adopting an updated classification and management scheme is prudent for the WVDNR to identify native Brook Trout as a priority species for protection, consistent with the West Virginia State Wildlife Action Plan (2015), while maintaining diligence in conserving other quality wild trout resources and managing all trout resources to their highest potential across the state for the optimization of all anglers' experiences.

WV TROUT STREAM CLASSIFICATION

Table 1.

Classification of trout waters from the 1990-2000 Long Range Comprehensive Sport Fisheries Plan.

Category	Management Philosophy
I - Self-sustaining trout waters	Receive little or no stocking of hatchery-produced trout
II - Fingerling waters	Fishery maintained primarily through annual stocking of fingerling trout intended to grow to catchable size in a natural environment
III - Mixed-management waters	Receive an annual stocking of fingerling as well as regular stockings of larger, hatchery-produced fish
IV - Catchable trout waters	Receive only stockings of larger, hatchery-produced trout
V - Stocked Lakes	Primarily warmwater lakes seasonally stocked with catchable-size trout

Table 2.

Five management classes described in the WV D-J Federal Aid in Sport Fish Restoration Project F-10-R (#'s 18-43), Job I-8, trout stream classification. See Appendix 4 for ratings.

Class	Rating Score	Fishery Description
1	22 - 30	A stream that would be expected to have a native or wild trout population. No trout stockings should be made in these streams. If trout are not present, considerations will be given to establishing them by stream reclamation and fingerling stockings.
2	16 - 21	A stream that should have trout carry-over and may have some successful trout spawning. Such streams should receive fingerling stockings and/or "put-and-take" stockings.
3	7 - 15	A stream capable of supporting trout through the spring and early summer. "Put-and-take" trout stockings are necessary to provide a trout fishery.
4	0 - 6	A stream that will not support trout throughout much of the year. Such streams should either not be stocked or be stocked as a warmwater stream. Streams in this category should be reviewed closely before trout are stocked.
5	Any	Regardless of rating, any stream which is polluted, pH-impacted, and/or devoid of fish, including any stream that may periodically go dry.

New West Virginia Trout Stream Management Classification

I. **ALLOPATRIC Wild Brook Trout Streams**
   - A. Within accepted native range
     1. ≥ 20 lbs. /acre[1] standing crop with good size/age structure – Management Scheme A
     2. < 20 lbs. /acre standing crop – Management Scheme B
   - B. Introduced outside accepted native range[2]
     1. ≥ 20 lbs. /acre standing crop with good size/age structure – Management Scheme A
     2. < 20 lbs. /acre standing crop – Management Scheme B

II. **SYMPATRIC Native Brook Trout with Brown and/or Rainbow Trout Streams**
   - A. Within accepted native Brook Trout range
     1. ≥ 20 lbs. /acre standing crop with good size/age structure – Management Scheme B
     2. < 20 lbs. /acre standing crop – Management Scheme B
   - B. Introduced outside accepted native Brook Trout range
     1. ≥ 20 lbs. /acre standing crop with good size/age structure – Management Scheme C
     2. < 20 lbs. /acre standing crop – Management Scheme C

III. **WILD Brown and/or Rainbow Trout Streams**[3]
   - A. ≥ 20 lbs. /acre standing crop with good size/age structure – Management Scheme C
   - B. < 20 lbs. /acre standing crop – Management Scheme C

IV. **Fingerling Supported Streams – Management Scheme C**
   - A. No measurable consistent reproduction, but good growth and carry-over of Brown Trout and/or Rainbow Trout

V. **Mixed-Management Streams – Management Scheme D**
   - A. May or may not have native Brook Trout or other wild trout present, generally at low abundances
   - B. Seasonal stocked streams with substantial carry-over
   - C. May be enhanced with fingerling stockings

VI. **Catchable Stocked Trout Streams – Management Scheme C**
   - A. Seasonal recreational trout fishery; little to no carry-over

VII. **Catchable Stocked Trout Impoundments – Management Scheme C**
   - A. All impoundments with trout regardless of carry-over

WV TROUT STREAM CLASSIFICATION

Management Schemes

A. Protect, conserve and enhance native (and regarded native) Brook Trout fishery

B. Implement management strategies to improve native (and regarded native) Brook Trout component of fish community — favor Brook Trout over any competing species

C. Manage to maximum recreational fishery potential through using any combination of physical, biological or chemical means

D. Implement management strategies to improve native Brook Trout (where present) without being detrimental to overall trout fishery — skew actions toward Brook Trout favor when feasible

Notes

1. 20 lbs./acre is arbitrary but presents as a good native Brook Trout fishery to the seasoned angler. A cursory literature search identified research from New England to the Great Smokies National Park referring to good Brook Trout fisheries as low as 10 lbs./acre. As an example, a Seneca Creek survey from 2006 was 160 meters long with an average width of 7.7 meters for an area of 1232 m2. We got 20 Brook Trout from 25-367 mm (2 >14-inches) and 20 Rainbow Trout from 108-283 mm. Brook Trout standing crop was 16.51 lbs./acre and the total trout standing crop was 26.68 lbs./acre. It was a lot of trout biomass for that section of stream and a tremendous opportunity for an angler to catch many quality fish. And as a new survey crew was being trained that day, about half the trout in the swifter riffles and runs of the reach were not captured.
2. North and east of the New River Gorge is regarded as native range. There are pockets of wild Brook Trout populations that have become regarded as native due to the quality of the fishery and the importance of maintaining it as an ecosystem service.
3. Wild Brown and Rainbow trout streams have become established outside the native Brook Trout range where coldwater temperatures and quality habitat coincide. Unless there is a conflict with other aquatic species conservation, these streams are of high value for fisheries and ecosystem services.

Average native Brook Trout weights in late summer	Estimated length range of native Brook Trout age classes by late summer
Age-0: 0.17 ounces	Age 0: < 4.2 inches
Age 1: 0.76 ounces	Age 1: 4.2 – 6.2 inches
Age 2: 2.29 ounces	Age 2: 6.2 – 8.9 inches
Age 3: 5.71 ounces	Age 3: 8.9 – 10.9 inches
Age 4: 10.02 ounces	Age 4: > 10.9 inches

Cultural Basis and Perceptions of Wildness

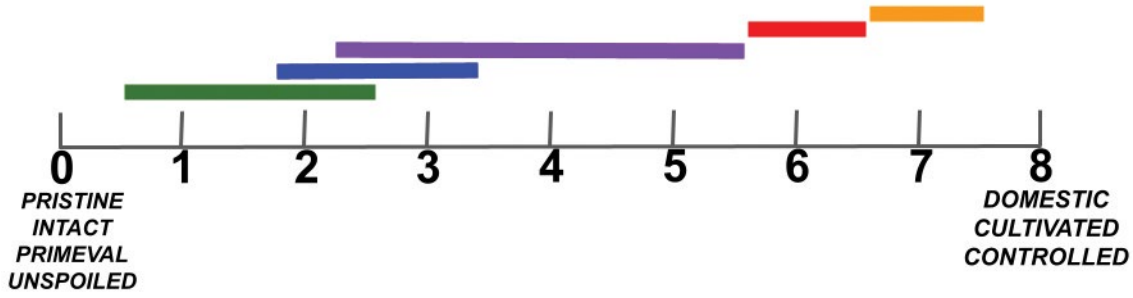
Wildness and tameness have been contrasted throughout the course of history, with the relative value of each changing as civilizations and societies evolved. The inclusion or separation of humans as a part of nature is often the central tenet of discussion with western cultures viewing man's separation or even dominion over nature as a definition of "civilized." In contrast, many indigenous cultures perceive humans as just a part of nature. A relatively recent paradigm shift among some in western culture, due to Darwinism and environmentalism, has renewed the argument that humans must be considered a part of nature, and therefore wildness, rather than separate and independent of it.

Various attempts have been made to identify the characteristics of wildness. Wildness has been considered the part of nature that cannot be controlled, retaining a measure of autonomy apart from human constructions (Evanoff 2005). Similarly, Hoaen (2019) considers that the products of wildness are natural, and those of humans are artificial (man-made). This supports a perception of some that naturally produced items are more elegant than artificial things.

Wildness can also be considered nothing more than a social construct (Callicott 2004) and that humans must be considered a part of this "nature." Ecologically, levels of wildness imply the degree of influence of natural selection pressures, acting independently or in concert, to ensure persistence of an organism or population. By this logic, humans are unnatural (lacking wildness), being largely insulated from many natural selection mechanisms such as predation and disease through the development of technologies. The human influence on nature, however, is ubiquitous, and must be considered a characteristic when rating wildness.

Management of West Virginia's trout resources, framed within this discussion, is the degree of human intervention that determines the persistence or survival of a given individual trout or the population to which that trout belongs. Any consideration of a scale of "wildness" of any particular trout or population must also regard the level of influence of human alterations on the natural order or autonomy of that individual or population.

THE WEST VIRGINIA TROUT WILDNESS SPECTRUM



- High quality native Brook Trout population
- Moderate quality native Brook Trout and wild Brown and/or Rainbow Trout
- Wild trout and mixed management – skewed left with native Brook Trout presence and right with their absence; often fingerling-supported streams
- Seasonal "catchable" stocked streams
- Seasonal "catchable" stocked impoundments

Shift to the Right on the Spectrum Leads to:

I. Decreasing level of challenge to pursue angling activity,
II. Decreasing level of personal risk to pursue angling activity,
III. Decreasing level of remoteness and solitude in pursuit of angling,
IV. Increasing level of contact with others in pursuit of similar angling activity,
V. Increasing level of management to provide a similar angling satisfaction.

WV TROUT STREAM CLASSIFICATION

Values along the spectrum ranging from 0 to 8 represent the extremes of wildness

0. No evidence of human interaction or control over the trout population or species. Only natural order dictates survival, persistence, or demographic trends or capacity.
1. Minimal human interaction affecting the persistence of a specific native trout population. Influences are indirect and unintentional (air and water pollution) and cause no observable effect to the population.
2. Human influences may affect habitat quality to the point of reducing reproduction effort or success, regulating the population at a reduced level, or by limiting the population to the point of reduced genetic diversity or increased risk of extirpation in the event of a stochastic event. Human introductions of exotic species, whether competitive or simply supplementary, may be evident.
3. Native Brook Trout persist but may only be transient due to connectivity to 0, 1, or 2 types. Wild Rainbow and Brown Trout populations have been introduced and are persistent and thriving.
4. Self-sustaining population is not persistent over a long term. Regular environmental perturbations reduce annual survival, reproductive effort, reproductive success, and recruitment. Regular plantings (annually) of hatchery-reared fingerlings provide the bulk of age 0 and 1 individuals and is necessary to maintain a consistent fishery.
5. Some streams that are stocked may not have reproduction, but have sufficient resources (cold water, food, refugia) to carry-over significant numbers of fish from year-to-year. These streams may be supplemented with fingerlings periodically or even annually to approximate a more diverse age class distribution to mimic a more natural population condition.
6. Streams that are incapable of supporting trout for more than the winter and spring months. These can provide adequate habitat for angling opportunities during the stocking season and as long as the fish continue to survive into the warmest part of the year. No implied wildness.
7. Man-made impoundments that are stocked with man-made hatchery-reared fish. There is no doubt a pleasant recreational experience is possible, but there is nothing about the fishery that is autonomous.
8. Generally, places where trout are raised or kept by man for man's bidding. Government or private hatcheries, aquaculture facilities, "natural history" exhibits of museums or zoos, etc. are places where humans interact to create, maintain, and enjoy the non-angling observation of trout and trout populations.

Hatchery Program Management

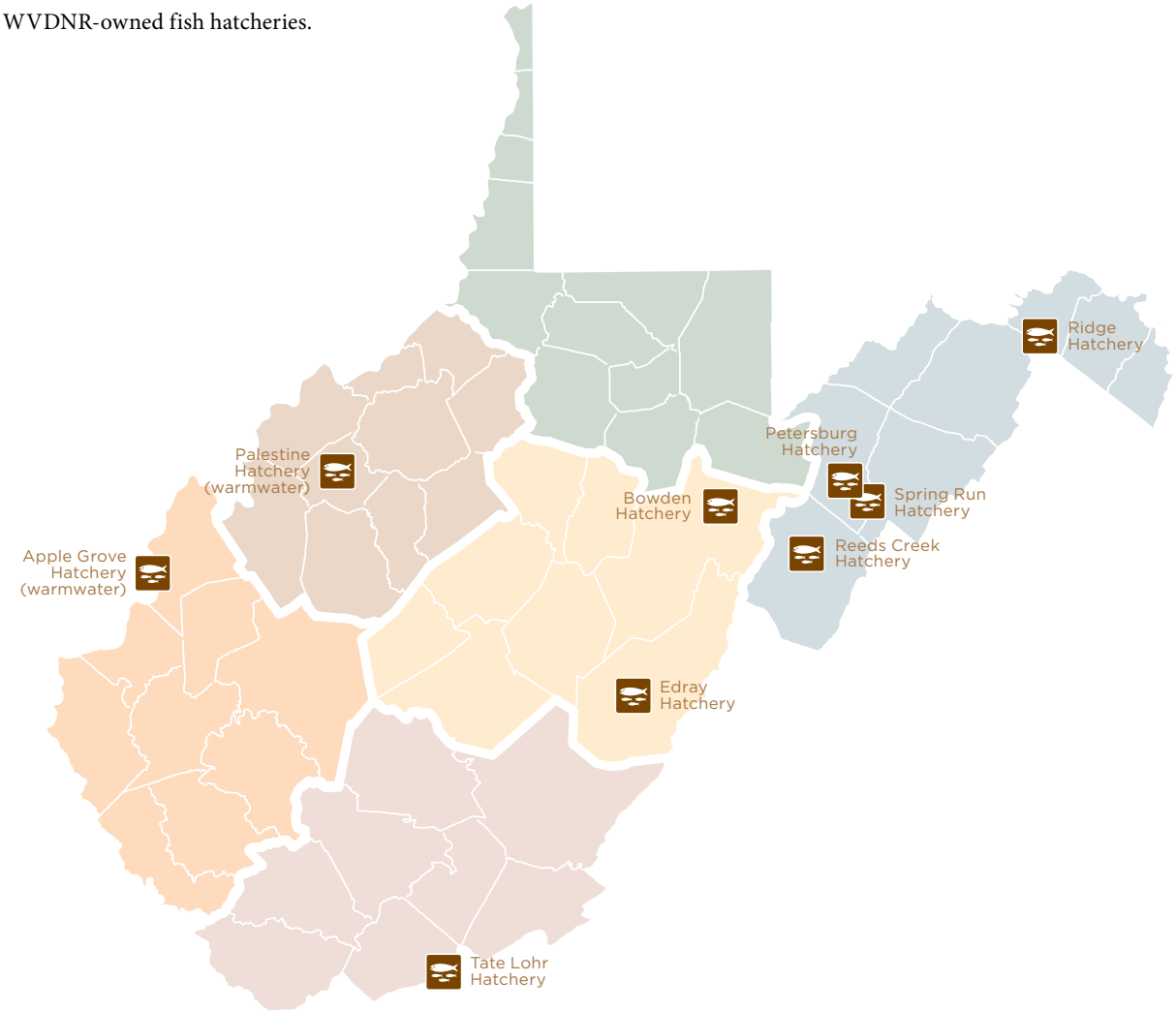
The West Virginia Hatchery Program is managed under the Fish Management program. The Fish Management program is part of the Wildlife Resources Section of the Division of Natural Resources. The WVDNR owns and operates seven (7) coldwater hatcheries that raise mostly trout and two (2) warmwater hatcheries that raise a variety of fish species including catfish, musky, hybrid striped bass, and walleye (Figure 1). The hatchery program is composed of 40 full-time staff members and numerous seasonal employees to assist with fish stocking and spawning (Supplementary Material Appendix 1).

Hatcheries require several WVDNR staff to raise fish and maintain the facility. Hatchery managers oversee the day-to-day operations and maintenance of each facility. All hatchery managers live on site to maintain security and respond to unexpected emergencies that could threaten the fish. Hatchery manager assistants focus on fish production and maintenance. The hatchery manager assistants provide support to the hatchery manager by leading fish and wildlife technicians to ensure tasks are completed in a timely manner. All hatchery staff must work cooperatively to complete tasks and culture fish for stocking throughout the state. All hatchery positions are labor intensive and require staff to often work in challenging weather conditions. Hatcheries are staffed seven days/week for fish care and observation.

All WVDNR fish hatcheries are open for public visitation from 7:30 a.m. to 3:30 p.m. unless hazardous conditions or limited staffing forces public closure. Individuals and groups should always coordinate their visit prior to arriving at a hatchery.

Figure 1.

Location of WVDNR-owned fish hatcheries.



History of Trout Stocking in West Virginia

In the early 1800s, reports of fish harvest throughout West Virginia were measured by the wagonloads. By 1877, fish, even in the best streams, could no longer be relied upon as a food supply. It had all changed due to stream pollution, habitat loss, and overharvest. In 1877, the Fish Commission was established and consisted of three members. During that first year, the commission raised and stocked trout, salmon, shad, and bass with a very small budget. The Fish Commission stocking program was short-lived and was discontinued in 1883. The commissioners stated that "the total disregard of the law in relation to fishing and the greediness with which all trout streams are now fished render it almost hopeless to expect that the supply of these fish (stockings) in and of our streams can be kept up except at a very heavy expense." (Kinney 1963a, 1963b, 1963c). The commissioners did not know how correct their statement would still be almost 150 years later. The WVDNR Hatchery Program cost approaches $4 million annually, and a common angler response is "more fish, bigger fish, more stocking."

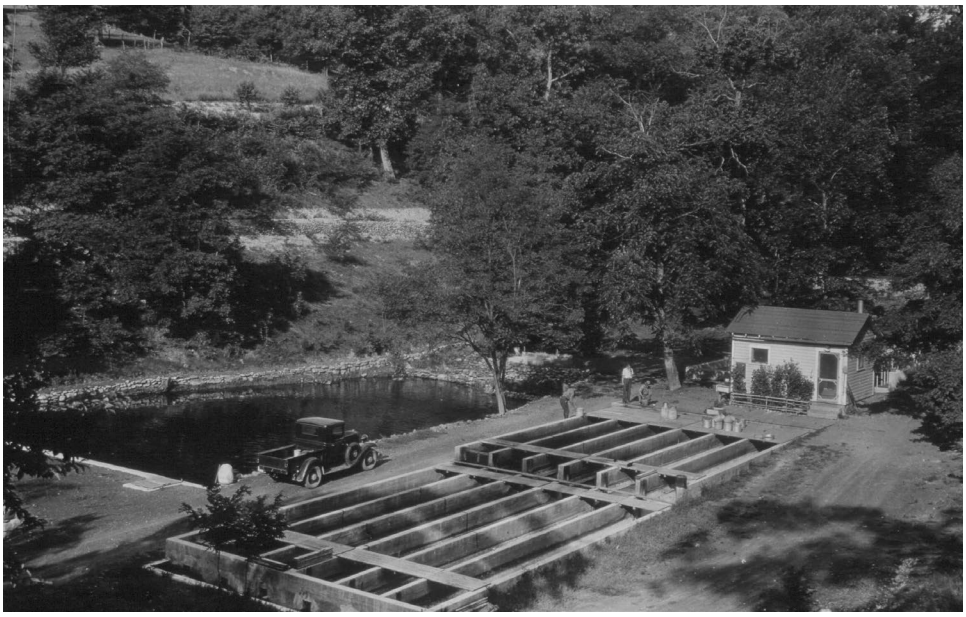
In 1887, the legislature passed an act, which provided the first game and fish warden. Greater restrictions were continuously placed on fishing until a closed season was established for several species, including trout, and fishing was prohibited on many streams. Even then, fish populations continued to decline because of pollution and habitat loss. The peak removal for virgin timber in West Virginia was in 1909 and in 1911 the West Virginia Fish and Game Protection Agency was established.

The West Virginia Game and Fish Commission was established in 1921; additional regulations followed, and hunting and fishing licenses were required for the first time. The first fish culturist was hired in 1927 and the Ridge and Edray Hatcheries were constructed, with other hatcheries soon following (see photos below and at right). A new funding opportunity arose in 1951 with the passing of the federal Dingell-Johnson Sport Fish Restoration Act in 1950; this provides much of the funding for the hatchery program to this day.

In the early years of fish culture, fish growth was slow and culturing techniques were often based on a trial-and-error method. In modern times, extensive fish culture research has responded to the worldwide concerns for decreasing fish stocks and culture techniques have become more efficient and effective. Commercial fish foods now provide protein and fat levels that are optimal for fish growth. The use of aeration and oxygen has increased the number of fish that can be effectively cultured in a confined space and safely transported.

West Virginia is one of the top states in the nation for the number and size of trout stocked. Many non-resident anglers from surrounding states purchase licenses to trout fish in West Virginia for a good reason. The beauty and seclusion that can be found in West Virginia coupled with the average size of stocked trout are difficult to find anywhere else in the Eastern United States.

Edray Hatchery additional construction in 1935.



Petersburg Hatchery,
Home of the Golden Trout 1933.

Law Enforcement

The WVDNR employs up to 126 Natural Resources Police officers who protect West Virginia's natural resources including trout and coldwater habitat. The Law Enforcement Section (LES) utilizes various patrol and education methods to accomplish this protective mission. The LES regularly patrols streams stocked with trout areas regularly to enforce all fishing regulations as well as littering. Because trout fishing occurs statewide, the LES relies heavily on angler participation and information. The LES has an anonymous online reporting system West Virginia DNR–Law Enforcement (WVdnr.gov) that allows citizens to report violations. The LES also encourages anglers to utilize the non-emergency 911 and district office phone lines to report in progress violations.

The LES also utilizes education and outreach to promote compliance with trout fishing regulations. Natural Resources Police officers participate in various fishing events across the state. Additionally, the LES interacts with schools and other fishing and community groups to support the trout management program and a clean environment.

The LES is mostly funded through license sales. Natural Resource Police will continue to support the mission of the WVDNR. Officers enforce the 200 foot-safe distance for hatchery truck personnel during trout stockings. While some of these measures were enacted during our COVID-19 protocol, it proves to be sound practice for the safety of all involved.

Funding

Nearly half of the West Virginia Division of Natural Resources fisheries budget is allocated to the Coldwater Fish Management Unit (CFMU). The CFMU includes all hatchery staff and some biologists. Two sources fund the CFMU. The primary funding source is fishing licenses, which include the resident and non-resident fishing license, sportsman's license, one- or five-day fishing license, trout fishing stamp, and the lifetime fishing license. The sale of resident fishing licenses has continued to fall over the past 20 years (Figure 2, Table 3). The sale of non-resident licenses has remained steady of the past 20 years with some increase in short-term licenses (Figure 3, Table 3).

The second funding source is through the Federal Aid in Sport Fish Restoration Act. The Sport Fish Restoration Program operates through excise taxes placed on fishing tackle, fishing electronics and motors, motorboats, and boating fuel. The Sport Fish Restoration Act was enacted in 1950 and has since been amended to provide funds for motorboat access (Wallop-Breaux amendment, 1984) and non-motorized watercraft (SAFETE Act amendment, 1992). These federally collected funds are allocated to states (also: tribes and the District of Columbia) based on the acres of fishable water and the number of fishing licenses. Funds granted to WVDNR by the Federal Aid Program require a 25% cost-share from WVDNR. The funds for this cost-share comes from fishing license sales. The WVDNR does not receive any general revenue tax money from state income tax or sales tax. Therefore, WVDNR is funded solely from sales of hunting and fishing license purchased by the sports men and women and from federal funds. The total annual budget for the Wildlife Resources Section is divided into six sections to provide funding for all aspects of fish and wildlife management (Figure 4).

Figure 2.

20-year trend of resident fishing and resident fishing-related license sales.

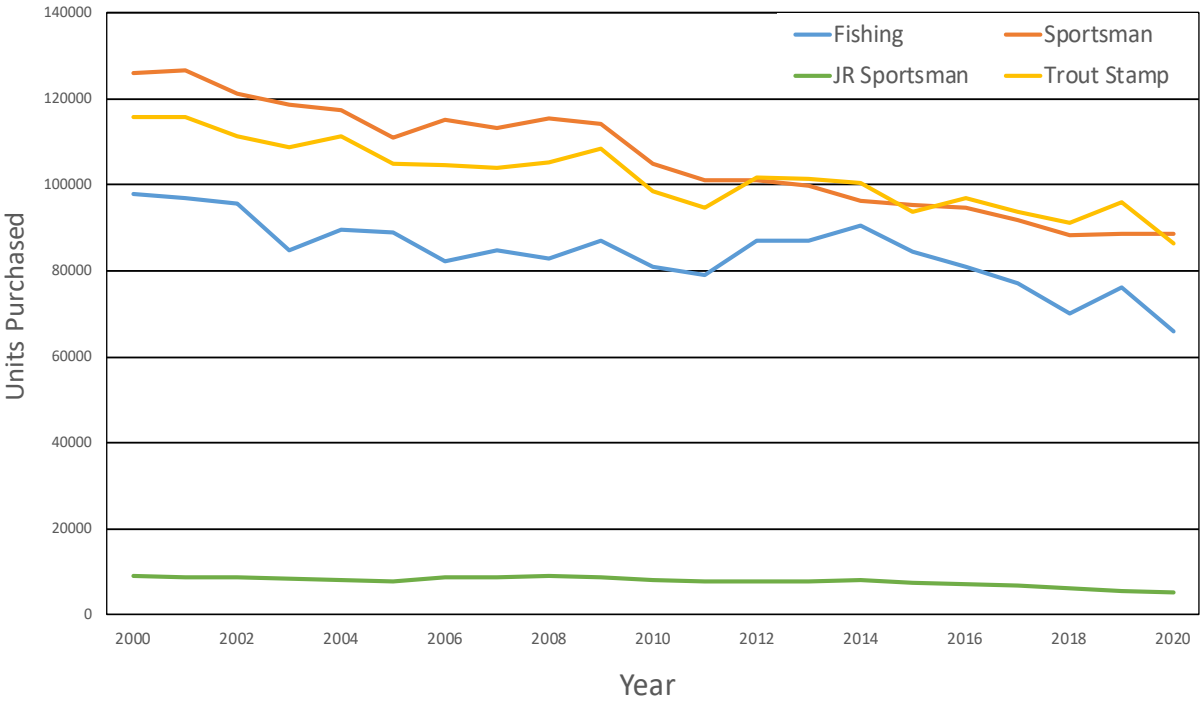


Figure 3.

20-year trend of West Virginia non-resident fishing and non-resident fishing-related license sales.

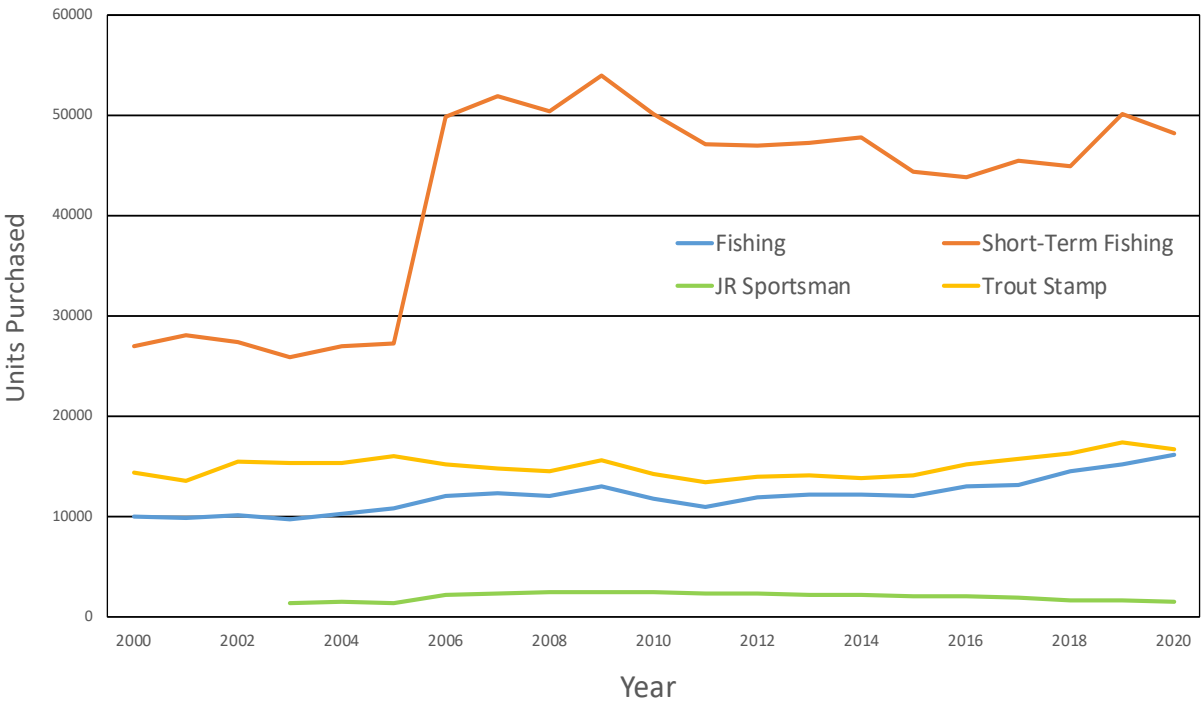


Table 3.

Total number and value of WV resident and non-resident fishing and fishing-related licenses sold during the 2019-2020 fiscal year.

Resident Fishing License Sales for 2019-2020

License Type	License Code	Price	Number Purchased	Total Sales
Fishing	B	$19.00	76,076	$1,445,444.00
5-day Fishing	L	$8.00	2,207	$17,656.00
Sportsman Hunting/Trapping/Fishing	X	$30.00	88,548	$2,656,440.00
Junior Sportsman Hunting/Trapping/Fishing	XJ	$11.00	5,658	$62,238.00
Trout Fishing (stamp)	O	$10.00	95,303	$953,030.00
LIFETIME Fishing	B-L	$552.00	30	$16,560.00
LIFETIME Sportsman	AB-L	$805.00	315	$253,575.00
LIFETIME Trout (stamp)	O-L	$230.00	144	$33,120.00
LIFETIME Fishing - Infant	B-L-I	$402.50	21	$5,796.00
LIFETIME Sportsman - Infant	AB-L-I	$276.00	1,168	$470,120.00
LIFETIME Trout - Infant	O-L-I	$115.00	506	$58,190.00
TOTALS			**269,976**	**$5,972,169.00 ***

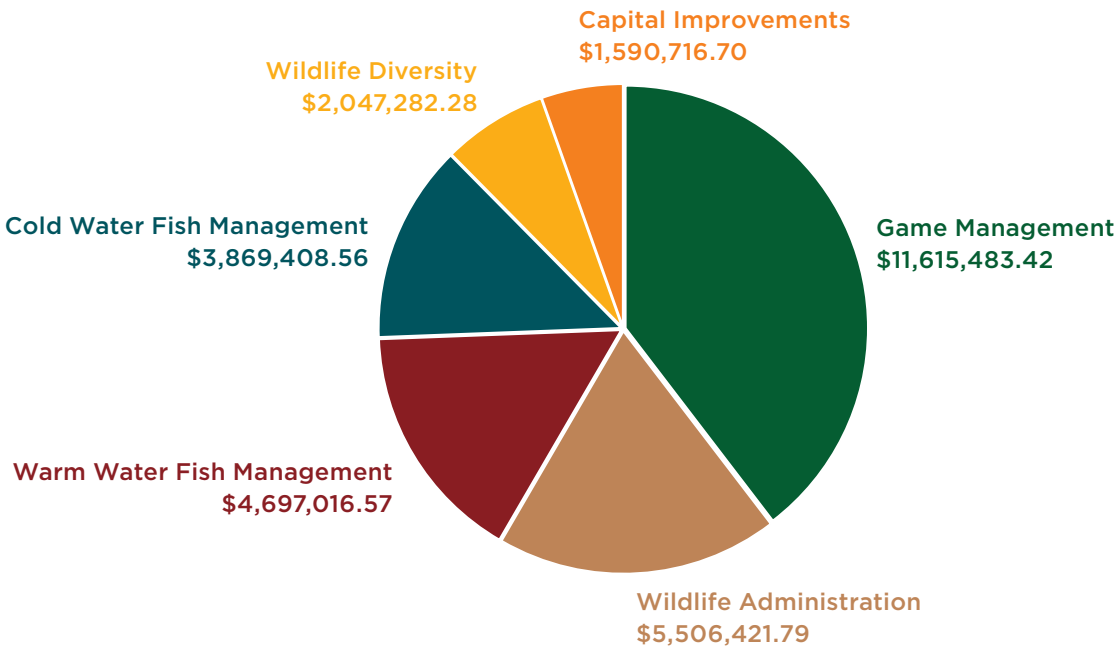
Non-Resident Fishing License Sales for 2019-2020

License Type	License Code	Price	Number Purchased	Total Sales
Fishing	F	$37.00	15,154	$560,698.00
1-day Fishing	LL	$3.00	50,033	$150,099.00
Junior Sportsman Hunting/Trapping/Fishing	XXJ	$16.00	1,634	$26,144.00
Trout Fishing (stamp)	OO	$16.00	17,381	$278,096.00
TOTALS:			**84,202**	**$1,015,037.00 ***

* Totals represent funds obtained from Sportsman Licenses, which offer not only fishing, but hunting and trapping opportunities, as well.

Figure 4.

WVDNR Wildlife Resources section budget allocation for the 2019-2020 fiscal year.



Catchable Trout (Put-and-Take Trout Waters)

DESCRIPTION

Fish stocking programs are typically designed to achieve several potential goals. Trout stocking can provide restoration of an extirpated species, supplement existing stocks where reproduction is not adequate for sustainability, and to provide a recreational fishery not possible through natural reproduction. The primary goal of the WVDNR Trout Stocking Program is to provide a recreational fishery where natural reproduction does not exist.

Recreational trout stocking can be used in a variety of ways to create different trout fishing experiences. The put-and-take trout fishing regulations in West Virginia apply to most stocked waters and under these regulations trout are available for immediate harvest following a stocking event. Like most other management strategies, trout stocking strategies have both pros and cons.

Pros:

- Attracts anglers to participate in trout fishing activities
- Provides angling opportunities for young anglers to become interested in fishing activities
- Allows trout harvests beyond what natural systems could produce or sustain
- Provides a significant benefit to state and local economies
- Can be used to reintroduce rare or locally extinct populations to develop a natural reproducing population

Cons:

- Can create an unreasonably high fishing expectation
- Can result in angler crowding on stocked waters and conflicts with anglers seeking solitude
- Can encourage poor fishing ethics, conflicts with private landowners, and reduced access to streams
- Can cause competition with natural wild stocks
- Can result in disease transmission to natural fish in the ecosystem
- Can cause genetic concerns if cross breeding with wild fish occurs

REGULATIONS

Regulations are promulgated to achieve different fish management outcomes. The most common regulations used in fish management are those that affect harvest. These include harvest season restrictions, creel limits, and size limits. Prior to 1966, West Virginia had a closed trout season with an opening day every spring (See the Year-Round Season section for details). Since 1966, West Virginia has had a year-round season with a daily creel limit of six (6) trout on both streams and lakes. This means each licensed angler may harvest no more than 6 trout within a given day. A 12-fish possession limit means an angler can have not more than 12 fish in possession (for example in your cooler) from multiple days of fishing. An angler is not permitted to catch six (6) fish, put them in a cooler and catch six (6) more on the same day. Anglers are also not permitted to catch more than six (6) fish per day even if they give them to someone else. The purpose of a creel limit is to conserve fish for other anglers in a put-and-take stream and to prevent overharvest in a wild or native stream, which could have detrimental impacts to a naturally reproducing fish population.

Size limits are another commonly used tool in fish management. Size limits can include a minimum harvest size but may also utilize maximum size limits or reduced creel limit over a certain size. Slot limits could include either a size range of fish for harvest or a size range that must be released. These types of regulations are recommended by professional fish biologists who have scientifically investigated the fish populations and understand management strategies that will protect or enhance a population. No size limits for trout currently exist for West Virginia.

Other regulatory strategies can be found in the “Special Regulation Waters” sections of this document. Fishing regulations are updated annually and include all season, size limits, and a list of Special Regulation Waters. A copy of the West Virginia Fishing Regulations can be found online at WVdnr.gov or at most license agents.

Catchable Trout (Put-and-Take Trout Waters) continued

STOCKING ANNOUNCEMENTS

Historically, the WVDNR has conducted most trout stocking events on a random, unannounced schedule. At the end of each day, stocked waters are posted on the WVDNR webpage in addition to a call-in line where anglers can hear a recorded message listing the waters stocked for that day. The primary purpose for unannounced stocking events is to create unhindered stream and lake access for the stocking staff to safely and more easily complete stocking events.

In 2018, the WVDNR began to pre-announce trout stockings for selected waters. The purpose of the pre-announced stocking program was to provide a stocking schedule prior to trout stocking events that would make it easier for anglers to plan a fishing trip. All pre-announced stocking events occurred on Friday and Saturday and target waters at a State Park or within a short drive from a State Park. For these stockings, State Parks offered additional accommodations and facilities for families and anglers from out-of-town.

West Virginia University in cooperation with the WVDNR conducted in-person and online creel surveys to evaluate angler satisfaction with pre-announced trout stocking events. Between April and June of 2020, a total of 1,785 respondents indicated a preference for unannounced stocking compared to pre-announced stocking. Respondents also preferred stocking on weekdays rather than on Saturdays.

STOCKING RATES

The poundage of stocked trout allotted for any stream or lake in the state is determined by several factors. These factors include the following:

- Acres of water being stocked
- Statewide stocking factor
- Suitability for stocking

The acreage used to determine stocked trout waters is calculated differently for lakes and streams. Lake and pond size is determined by the area of the water at normal elevation. In streams, the acreage is determined by the stream length of a stocking reach multiplied by the average width of the stream at normal flow.

The statewide stocking factor is the most complicated element of the stocking allotment calculation. The statewide stocking factor essentially refers to the pounds of fish to be stocked per acre. However, this factor may be modified based on the pounds of fish available in the hatcheries. The easiest way to think of the stocking factor number is essentially, the total pounds of trout available in all seven trout hatcheries divided by the total acres of water in all streams and lakes to be stocked.

The stocking factor provides a method to account for variable hatchery production from year to year and to distribute production in a fair and equitable manner for all stream and lakes. When fish in hatcheries have experienced good growth, the stocking factor is increased, and all stream and lakes statewide receive more fish proportionally per stocking event. During years with less fish growth, the stocking factor is decreased to ensure trout will be available to continue stocking as scheduled throughout the entire season.

The stocking suitability is a multiplier between 0 and 1 and is used to evaluate if the stream or lake meets stocking criteria. These stocking criteria include public access, parking, landowner compliance, and the number of stocking locations throughout the stocking reach. For example, if a stream has only a few stocking locations over a 15-mile segment, the stocking suitability would be reduced so too many fish are not stocked at a single location. The suitability would also be reduced for a lake if terrain prohibits access, access is restricted by the owner, or a section of the lake is designated for a use other than fishing. Streams and lakes with good access typically have a suitability of 1.0, which makes no change in the allotment calculation.

Catchable Trout (Put-and-Take Trout Waters) continued

TROUT DISTRIBUTION

The distribution of trout in streams and lakes across the state is a major task for the hatchery program staff. After the cost of trout food, distribution is the second largest cost for the hatchery program. To reduce distribution costs, trout for stocking multiple waters may be loaded on a single truck. Trout are weighed and loaded in separate distribution tank compartments. Trout must be accurately weighed and not crowded too tightly to help them remain healthy during transport. Trout kept in separate compartments are designated for specific waters. Hatchery staff then know which compartments of trout should be stocked at specific locations.

Stocking trucks are equipped with aerators and compressed oxygen tanks to keep fish alive and healthy during transport. Trout stocking tanks are made of aluminum and the walls and lids are insulated to prevent the water from warming during transport. Trout are not fed prior to transport to avoid toxic waste and ammonia build-up in the truck tanks. Oxygen flows during the entire distribution and is never shut off prior to emptying the stocking tanks.

The Hatchery Program currently distributes fish to more than 200 streams and lakes in the state. Because many streams have numerous stocking locations, the hatchery staff stock trout at more than 2,000 different points. Many of these points are stocked multiple times annually, bringing the number of annual stocking events to more than 15,000.

Hatchery staff attempt to be as consistent as possible, stocking all available locations at each site. Distribution is often accomplished utilizing buckets and outside assistance. However, weather conditions often prevent all available spots from receiving fish. During the winter season, snow plowing can cause many roadside pull-offs to become inaccessible. Snow and excessively wet soil can also prevent stocking trucks from accessing areas off designated roadways. Regularly scheduled stockings are often missed due to inclement weather, equipment and stocking truck failures, and staff availability. Missed stocking are made up in two different ways — either by making additional stocking runs or by adding additional fish to proceeding stocking events to compensate for the missed stocking.

Landowners posting of private property signs frequently cause changes in distribution locations. If a stream landowner has posted their private property against trespassing, hatchery staff will no longer stock at that location. If posted property clearly designates only one side of the stream but still provides access to anglers on the opposite shore, stocking is often continued. As a rule, if an out-of-town angler would be unable to clearly identify where access and fishing is permitted, the location is removed from the stocking schedule.

Fish distribution can be a dangerous and extremely labor-intensive process. Many stocking locations throughout our state are adjacent to narrow roadways, steep grades, and sharp turns in the road. The annual trout stocking begins in January each year, when winter road conditions are often severe. Hatchery staff often stock trout during freezing conditions, which can cause ice to form on truck ladders and on the surface of the tank. All full-time hatchery staff are required to obtain a Class B Commercial Driver's License (CDL) with a liquid tank endorsement.

SELECTION OF SPECIES

The species of trout stocked at each site are based on biological criteria. Trout species stocked must be approved annually by the U.S. Fish and Wildlife Service Federal Aid Program for each stocked water. This approval is determined by evaluating any potential impacts to threatened or endangered species that could occur because of stocking. Additional biological consideration is given to potential species competition with resident fish populations and genetic integrity in the event a hatchery reared fish would spawn with a wild fish.

Another consideration for species stocking selection is the ability to be reared in a hatchery setting. Rainbow and Golden Rainbow Trout are reared in large numbers because they exhibit good survival and fast growth in intense fish culture situations. Brook and Brown Trout can be more difficult to culture and are reared and stocked in fewer numbers.

The WVDNR has recently starting rearing Tiger Trout after removing the species from the propagation list for several years. The Tiger Trout is a cross between a female Brown Trout and male Brook Trout. Historically, culture of Tiger Trout has faced some challenges. Although it is uncommon, Tiger Trout can occur naturally where both Brook and Brown Trout are spawning during the same period. Early mortality caused by genetic complications when the two species are crossed can cause high mortality rates at a young age. However, new techniques, which include pressure treatment of eggs, results in genetic modification, known as triploid. The triploid process for Tiger Trout reduces the genetic complications increasing survival of the young fish. Because of this process, the WVDNR has been able to more successfully culture Tiger Trout and resume stocking them in many waters.

Special Regulations Management in West Virginia Trout Streams

Special fishing regulations, those restricting harvest and/or tackle compared to general base regulations, have become a common management tool for conserving sensitive fisheries and diversifying opportunities for anglers. The use of special regulations in West Virginia is a long and colorful part of the management of trout resources in the state. A variety of restrictions and reasons are evident in the record of fishing regulation changes through the years in the published regulations, as well as the documented discussions throughout the myriad paper notes and memos remaining in the file archives.

"Fish-For-Fun" was the original term coined to frame the prospect of releasing one's catch to be pursued again by others just for the pleasure of angling. It was an interesting turn of phrase, as fishing today in developed nations is regarded as a pleasurable pastime, much more a recreational pursuit of fun than the need to provide a source of food. In the 1960s (the first C&R fishery was in Michigan in 1952), West Virginia was still largely a family farming society, and the thought of recreation or leisure time to most was a relatively new concept, so time spent fishing required more reward than catching fish just to throw them back in the river. In places, Fish-For-Fun streams allowed the harvest of a single trophy trout, perhaps one worthy of preserving with a permanent mount rather than eating. At times, some streams have been completely closed to all fishing for conservation and research purposes. Mostly, though, special regulations in West Virginia came about after the trout program went to a year-round fishing season, ensuring some fish survived through the spring to provide summertime trout angling opportunities in select appropriate streams. And with the variety of trout waters existing across the state, a diversity of regulations has been instituted over the years, from exclusively fly-fishing opportunities in some of our most unique and sensitive waters to delayed harvest rules in those areas that can provide good fishing to many anglers early in the season but may get too warm to carry trout until the temperatures begin to cool into the fall.

The first "Fish-For-Fun" stream in the state, a four-mile section of Back Fork Elk River (Table 4), was opened at 5 a.m. on April 25, 1964, with the opening of that year's trout fishing season. It must have been popular, because despite some regulations changes through the years the same extent of that area remains under today's catch-and-release (C&R) (Figure 5) regulations. More evidence of the acceptance of the new format is that two more stream sections were added in 1965: Pinnacle Creek and Shavers Fork (Table 4). Unfortunately, these two areas apparently were not well planned or supported, as both regulations were reverted within two years of being implemented. Another section of Shavers Fork, within the Monongahela National Forest, replaced the contested section in 1967 and remains a popular C&R destination to this day. In 1970, the Back Fork Elk River and Shavers Fork regulations were amended to allow anglers to keep a trophy fish greater than 18 inches in length; all others still had to be released. Upon harvesting a trophy fish, though, an angler had to stop fishing for the day, even if their intent was to release everything else.

Spring of 1966 brought about a dramatic change in the trout program in West Virginia: the end of "opening day" and the adoption of a year-round fishing season. All streams no longer had a period of closure to fishing, with one notable exception. Otter Creek was closed to all fishing beginning this year for the assessment of a research project into the efficacy of using a prototype water-driven rotary drum to crush and deliver limestone to the stream to counter the increasing impacts from acidification. The implementation of the stream restoration program with limestone rotary drums and the subsequent transition to limestone sand treatments continued to affect conservation-related regulations through the years continuing to the present (Table 4, Figure 6). Regulations affecting angling in Otter Creek continued to be modified over the next several years as the results of the treatments upon the water quality and subsequent fishery were monitored. Ultimately, the stream was reverted to a general regulation scheme in 1981, as the native Brook Trout fishery appeared stable and unaltered by the regulations. One of the experimental regulations on Otter Creek was the restriction of gear to fly fishing tackle to further reduce angling pressures on the fishery. Other streams were also included under the fly fishing only (Figure 7) regulation around that same time for an alternative angling opportunity and as a request of private landowners that allowed their properties to be open to public angling access.

Edwards Run in Hampshire County was the first "Fly Fishing Only" (FFO) stream specifically for the recreational angler. It was a stocked stream, but its excellent spring-fed flows meant it had a one-mile section of the Public Hunting Area (eventually Edwards Run Wildlife Management Area) with cold temperatures for good survival over the summer and good insect hatches to acclimate the fish to a natural environment. The fly-fishing season was established from June 1 to the end of the year and it was under general regulations during the winter and spring stocking season. That same year, about a mile of Rich Creek in Monroe County, another cold spring-fed stream, became a FFO stream in cooperation with the local property owner. Both streams were eventually dropped from special regulations, Edwards Run in 1987 due to deteriorating habitat and poor fishing conditions, and Rich Creek in 1995 due to a desire of the landowner to discontinue the agreement.

Special Regulations Management continued

Specially regulated trout fishing areas continued to grow in popularity and use, even if their availability to anglers was growing only by small amounts. In the 1980's there were few additions, although there were several changes to existing regulations. Trophy fish harvest was dropped from both Back Fork Elk River and Shavers Fork in 1980, restricting them to C&R only, and a new section was added for FFO on 1.5 miles of Second Creek with the help of local Trout Unlimited volunteers and the property owners adjacent to the stream. Second Creek is a large spring-fed stream that continues to provide a great recreational fishery for fly anglers. Another new C&R area was added in 1982 with the ¾ mile section of the North Fork South Branch at the Seneca Rocks Discovery Center. It was certainly a popular location, and despite the catastrophic flooding of November 1985, it continued to be well used, especially once some restoration actions were taken to mitigate some of the habitat lost in the flooding. Water quality conditions notably deteriorated through the 1980's in Shavers Fork and other lightly buffered streams due to acidic precipitation. As a result, a fall harvest time was opened on the Shavers Fork C&R area, as trout holding over until the winter would perish from the acidic conditions. But new limestone drum research at Dogway Fork of the Cranberry River helped provide insight into ways to alleviate some of the impacts of the acid rain and snowmelt. In support of this research, Dogway Fork was closed to angling during the research period from 1989–1994.

The 1990s brought about a great surge in the popularity of fly fishing, creating a demand for increased opportunities for C&R anglers and fly-fishing in particular. Everyone wanted to be Paul Maclean in the movie "A River Runs Through It", and many sections and miles of water were added to West Virginia's special regulations portfolio through the decade (Table 4). Several streams were added as "delayed harvest" (DH), or a time-limited C&R period that would revert to general regulations when conditions became unsuitable for adequate survival and carry-over. Other sections of some of the best fishing waters in the state also were set aside for regulations to assure quality fisheries all year long without being stocked. It was also in the 1990s that Maryland added significant portions of the North Branch Potomac River, which it shares as a border water with West Virginia, to special regulations management. Among the most notable waters dedicated to the C&R anglers was the two-mile section of Elk River between Elk Springs and Whittaker Falls that was negotiated with local landowners in 1993. This has always been a very high-quality stream as it emerges from the ground in several springs after flowing subsurface through limestone caverns for over four miles. The cold and nutrient-rich waters are prime for trout survival and growth, and the habitat is excellent for food production, shelter, and reproduction, making this one of the premier trout fishing destinations in the state.

The discussions about protections of wild trout fisheries using special regulations and creating sustainable fishing opportunities came to the fore in this period as more waters were recovering from poor land-use practices of previous generations and the Clean Water and Clean Air acts were brought to bear in management of impaired waterways. In West Virginia, the treatment of streams impacted by acid precipitation transitioned from research to a management tool using crushed limestone sand application. Many miles of streams improved to become quality year-round wild and native trout fisheries where they may have only been sustained with seasonal stockings before. And additional technologies for the treatment of acid mine drainage made still other waters available as viable fisheries where none had existed for decades. The most notable treatment success was the recovery of the Cranberry River and Dogway Fork. Two separate C&R sections on the Cranberry and the FFO section of Dogway Fork were established in 1994 and remain popular and well used. In 1995, the short North Fork Cranberry River C&R area was designated to provide refuge for spawning trout that used the sweetened waters emanating from the limestone drum treatment station. By 1996, a treatment station was operating on the Blackwater River as well, restoring that river at least to the confluence with its North Fork. This notorious section of Blackwater Canyon, including the picturesque Blackwater Falls, was quickly identified as an important area for a C&R fishery, and a section within Blackwater Falls State Park has been managed as such since then.

A widening of the footprint of specially regulated waters into non-traditional trout waters since the original Pinnacle Creek designation began with the Clear Fork of Guyandotte River in 1997. While too warm to successfully carry over any but the hardiest of trout, enacting the DH regulation with C&R rules from March 1–May 31 stretched the fishing season and opportunity for anglers to catch some stream-wary trout throughout the spring months. Additionally, in 1998, a three-mile portion of Glade Creek in the New River Gorge National River (now a National Park and Preserve) was designated a year-round C&R area. A significant increase in waters available to anglers seeking alternative regulations occurred in 1999. Three new additions of nearly 26.5 miles of wild trout water were designated. The "Slatyfork" section of Elk River, home to wild Brown and Rainbow Trout as well as the occasional native Brook Trout, was protected with C&R regulations. Two Brook Trout watersheds were "restored" and protected by FFO restrictions. Red Run of the Dry Fork in Tucker County had become too acidic and had completely lost its native Brook Trout population. The Blennerhassett (Parkersburg) Chapter of Trout Unlimited (TU) "adopted" Red Run and paid the DNR for the limestone sand that was necessary to restore the water quality to a level to support a native Brook Trout population. Local native Brook Trout, plus Blacknose Dace and Mottled Sculpins, were transplanted into

Special Regulations Management continued

Red Run upstream of a barrier waterfall to establish a fishery. TU petitioned to have Red Run and its tributaries be managed under FFO regulations, and they were obliged due to their commitment to restoring the stream water quality and fish community. The second Brook Trout FFO watershed added in 1999 was Buffalo Creek in the New River Gorge. This stream was historically devoid of native Brook Trout, as are most tributaries in "The Gorge" due to the age of the New River and the steep slope and barrier waterfalls to prevent colonization from the main river. Ernie Nester and colleagues in the Kanawha Valley Chapter of TU (renamed the Ernie Nester Chapter after his passing) translocated native Brook Trout from streams with good populations into Buffalo Creek and established a self-sustaining fishery that was subsequently designated with the special regulation. Unfortunately, the wild Brook Trout fishery there has since failed due to a series of catastrophic flooding events. The stream appears to go dry periodically now and the fishery has not recovered. The regulation was removed in 2021.

The acquisition of a new property by the WVDNR created a welcome addition and a lot of "buzz" among the fly anglers of the state. The Thorn Creek WMA and the approximate ½ mile of high-quality Brook Trout FFO water were an immediate hit among the fly angling crowd in 2000. This marked only the third state-owned property and second WMA to provide a specially regulated trout fishing opportunity. In 2001, sections of two more non-traditional trout waters had special regulation areas established: DH on 1.2 miles of Middle Wheeling Creek and two miles of year-round C&R on Paint Creek. The Bluestone River in Pipestem State Park became DH in 2010 and changed to year-round C&R in 2020. The most dramatic change in regulation of trout waters happened from 2017 to 2019 with the protection of over 180 miles within eight stream systems by either C&R or FFO designations. Investments in habitat restoration and enhancement projects on parts of Seneca Creek and Mill Creek (Kumbrabow State Forest) led to the establishment of C&R regulations to protect the fisheries and the investments made in those streams. A one-mile portion of Spring Run already privately managed for FFO was acquired by the DNR in spring of 2018. An exemption in the yearlong regulation process was requested of the DNR Commission for the property and granted, placing the property seamlessly into public domain with immediate designation as a DNR-managed FFO water. In 2019, four large watersheds that had been restored (or planned to be restored) to a healthy native Brook Trout fishery with the application of limestone sand to treat the effects of acid precipitation were deemed in need of harvest protections. C&R regulations were implemented at that time for Tea Creek, Red Creek, Otter Creek, and the Middle Fork Williams River watersheds. That same year, the one-mile section of Edwards Run within the Edwards Run Wildlife Management Area was again designated as FFO regulations. A four-year effort to repatriate the stream with local native Brook Trout stock was successful in establishing a fishable population there, and the regulations were implemented to ensure fishing pressure and harvest did not undermine the restoration effort.

The use of special angling regulations more restrictive than the general regulation have become a popular tool of biologists to protect special streams and trout populations and to create a longer, more diverse season for anglers. The increasing use of special regulations by the West Virginia DNR through the years reflects the increasing desire of anglers for a longer fishing season and the sensitivity to the conservation of special fish living in special places. Plenty of opportunities continue to exist for anglers to legally harvest holdover, wild, and native trout, as well as all the seasonal stocked trout produced by the hatchery system. But the protection of unique and diverse trout populations will ensure those anglers and their successors will continue to have a quality trout fishing resource for generations to come.

Table 4.

Changes to special regulation trout areas in West Virginia through the years as described in annual fishing regulation brochures and published legislative rules. C&R=catch and release; FFF=fish-for-fun; FFO=fly fishing only; dh=delayed harvest; +=current regulations

Year	Area	Extent	Reg	Change	Notes	Season
1964	Back Fork Elk	4 miles	C&R	new addition - info from memo dated 10/17/1969	zero creel	closed March 1 to April 24
1965	Pinnacle Creek	3 miles	C&R	new addition	zero creel	year-round
1966	Otter Creek	limestone drum to Turkey run	closure	new closure	limestone drum research	no fishing
1967	Shavers Fork	6 miles	C&R	new addition; dropped within 2 months - landowner conflict	zero creel	
1968	Pinnacle Creek			dropped Pinnacle Creek from special regs		
1970	Back Fork Elk	same	FFF	18" min size, possession 1		year-round
1970	Shavers Fork	5.5 miles	FFF	18" min size, possession 1		year-round
1971	Otter Creek	not specified	FFO	re-opened to angling- creel & possession of 4 fish allowed	limited info in legislative rules	June 1–Sept 12, otherwise open or closed
1975	Edwards Run	1 mile	FFO	new addition	zero creel	June 1–Dec 31, otherwise general regs
1975	Otter Creek	entire watershed	FFO	zero creel, fishing year-round	zero creel - includes tributaries	year-round
1975	Rich Creek	unspecified, but <1 mile	FFO	new addition	zero creel	year-round
1980	Back Fork Elk +	same	C&R	dropped trophy harvest	zero creel	year-round
1980	Shavers Fork	same	C&R	dropped trophy harvest	zero creel	year-round
1980	Second Creek	1.5 miles	FFO	new addition	zero creel	year-round
1980	Rich Creek			dropped from special regulations	disappeared from legislative rules	
1981	Otter Creek			dropped from special regulations	includes tributaries as well	
1982	Rich Creek	same as previously	FFO	re-added	re-appeared in legislative rules	March 1–Dec 31
1982	North Fork South Branch Potomac +	0.75 miles	C&R	new addition	zero creel	year-round
1985	Shavers Fork		C&R - dh	established fall harvest due to acidity kills	zero creel	Jan 1–Hunt season opener, otherwise general regs
1987	Edwards Run			dropped Edwards Run from special regs		
1989	Dogway Fork		closure	new closure	limestone drum research	no fishing
1991	Williams River	1 mile	C&R - dh	new addition	delayed harvest	March 1–May 31, otherwise general regs
1991	South Branch Potomac River	1 mile	C&R - dh	new addition	delayed harvest	March 1–May 31, otherwise general regs
1992	Milligan Creek +	1/3 mile	FFO	new addition		year-round
1993	Elk River +	2 miles	C&R	new addition	Elk Springs section	year-round
1994	Cranberry River Forks to Dogway +	4.3 miles	C&R	new addition		year-round
1994	Cranberry River Woodbine +	1.2 miles	C&R	new addition		year-round
1994	Dogway Fork	unspecified	FFO	opened to fly fishing only	only mainstem	year-round

Table 4 continued.

Year	Area	Extent	Reg	Change	Notes	Season
1995	North Branch Potomac River *		C&R	new addition	Maryland—3 sections added—see MD annual regulation	year-round
1995	Rich Creek			dropped Rich Creek from special regs		
1995	North Fork Cranberry River +	0.25 miles	C&R	new addition		year-round
1996	Williams River +	2 miles	C&R	year-round C&R, extended to 2 miles		year-round
1996	Blackwater River +	3.5 miles	C&R	new addition	Blackwater Falls State Park	year-round
1997	Dogway Fork +	entire watershed	FFO	added entire watershed to regs	entire watershed	year-round
1997	Clear Fork Guyandotte	1 mile	C&R - dh	new addition	delayed harvest	March 1–May 31, otherwise general regs
1998	South Branch Potomac River +	same	C&R	year-round C&R	"Smoke Hole" section	year-round
1998	Glade Creek New River +	3 miles	C&R	new addition		year-round
1999	Shavers Fork +	same	C&R	year-round C&R		year-round
1999	Elk River - Slaty Fork section	3.6 miles	C&R	new addition		year-round
1999	Red Run +	entire watershed	FFO	new addition	entire watershed	year-round
1999	Buffalo Creek	entire watershed	FFO	new addition	entire watershed	year-round
2000	North Fork Cherry River +	2 miles	C&R	new addition		year-round
2000	Thorn Creek +	0.5 miles	FFO	new addition	Thorn Creek WMA	year-round
2001	Middle Wheeling Creek	1.2 miles	C&R - dh	new addition	delayed harvest	March 1–May 31, otherwise general regs
2001	Paint Creek +	2 miles	C&R	new addition		year-round
2004	Middle Wheeling Creek +	same	C&R - dh	C&R season lengthened	delayed harvest	Oct 1–May 31, otherwise general regs
2004	Clear Fork Guyandotte +	same	C&R - dh	C&R season lengthened	delayed harvest	Oct 1–May 31, otherwise general regs
2004	Elk River - Slaty Fork	4.6 miles plus tribs	C&R	added all tribs except Laurel Run, extended further downstream	added more streams & Length	year-round
2006	Elk River - Slaty Fork +	4.6 miles plus Big Run & Props Runs only	C&R	changed to include just Big & Props Runs	cleaned up vagueness	year-round
2008	all		C&R	changed to exclude scented & edible enticements clause		
2010	Bluestone River	1 mile	C&R - dh	new addition	Pipestem State Park	Oct 1–May 31, otherwise general regs
2011	Shavers Fork - Stuart Park	0.9 miles	C&R	new addition		year-round
2017	Seneca Creek +	0.2 miles	C&R	new addition	TU – USFS demo habitat project	year-round
2017	Mill Creek +	entire watershed	C&R	new addition	includes all tribs to Mill Creek in Kumbrabow SF	year-round
2018	Spring Run +	1 mile	FFO	new addition	Spring Run WMA–1 mile	year-round

Table 4 continued.

Year	Area	Extent	Reg	Change	Notes	Season
2019	Middle Fork Williams River +	entire watershed	C&R	new addition	entire watershed	year-round
2019	Tea Creek +	entire watershed upstream campground	C&R	new addition	entire watershed	year-round
2019	Red Creek +	entire watershed upstream Laneville	C&R	new addition	entire watershed	year-round
2019	Otter Creek +	entire watershed	C&R	new addition	entire watershed	year-round
2019	Edwards Run +	1 mile	FFO	new addition	within Edwards Run WMA—native Brook Trout restored	year-round
2020	Bluestone River +	same	C&R	year-round C&R		year-round
2021	Buffalo Creek			dropped from special regulations	failure of Brook Trout population	
2022	Shavers Fork - Stuart Park			dropped from special regulations	poor logistics, enforcement & use	

Figure 5.

Current legislated rules for Catch-and-Release (C&R) designated trout waters in West Virginia.

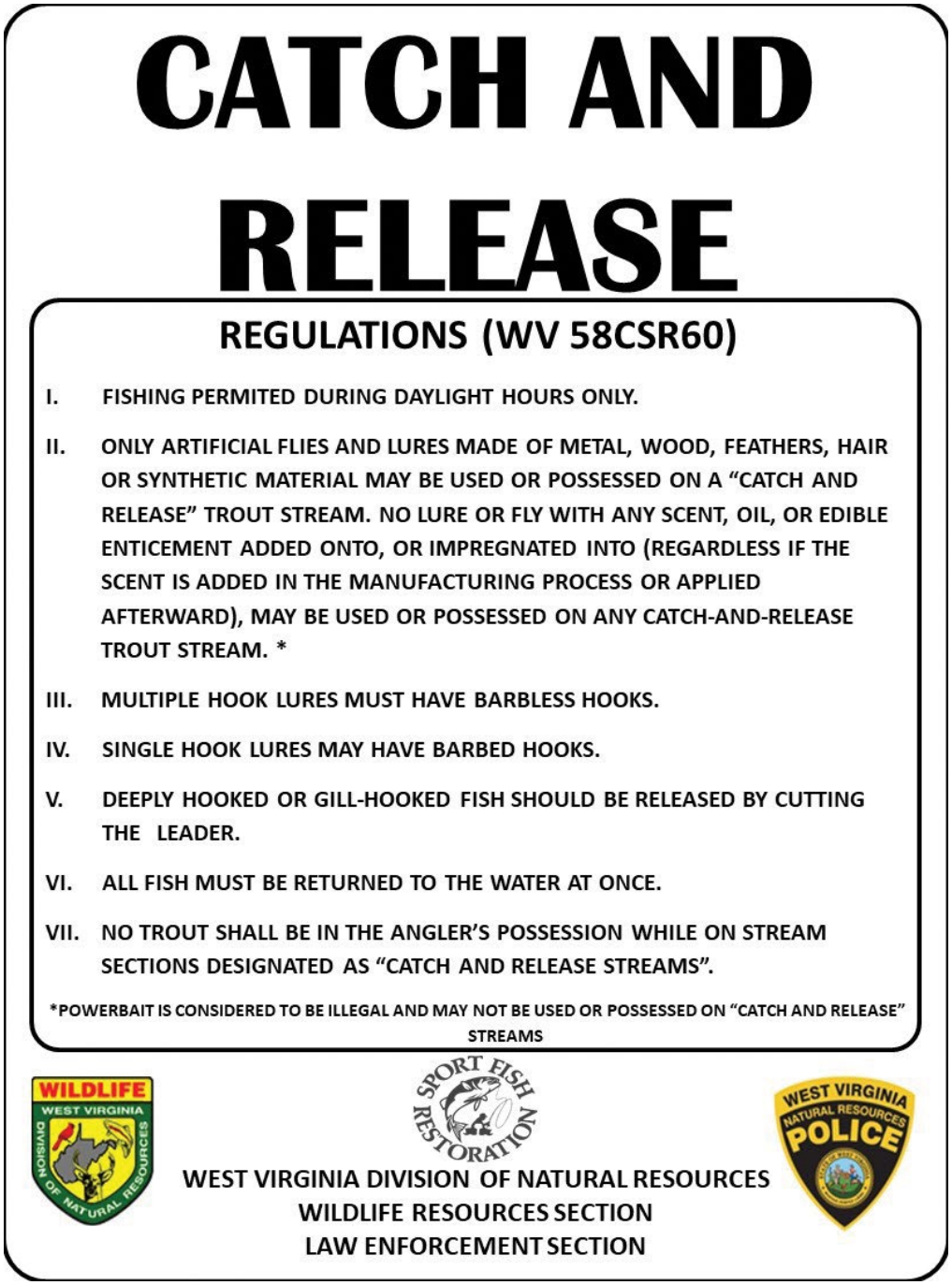


Figure 6.

Change in stream mileage of specially regulated trout streams in West Virginia from the earliest implementation to the present. Recreational fishing regulations are those waters that provide extended season or year-round fishing opportunities where trout may survive beyond the stocking season. Conservation-based regulations are intended to provide a research opportunity on a population closed to angling and harvest mortality, protect populations that may be sensitive to angling pressures or gear types, or protect a management investment in the landscape-scale restoration or enhancement of a population. No changes to regulations occurred between 1982-1987 or 2005-2014, indicated by break lines in the chart. * - Maryland regulations on the North Branch Potomac are included from 1995 to the present simply because they are accessible to anglers with a valid West Virginia fishing license.

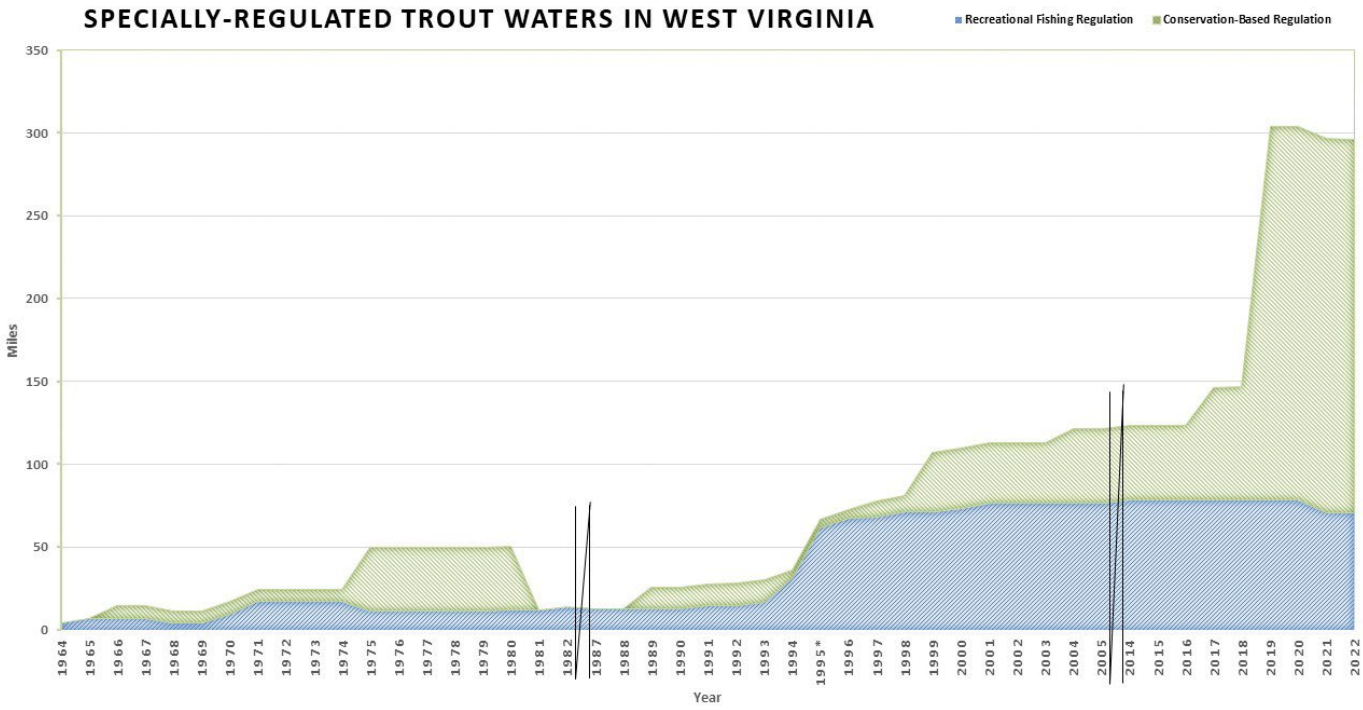
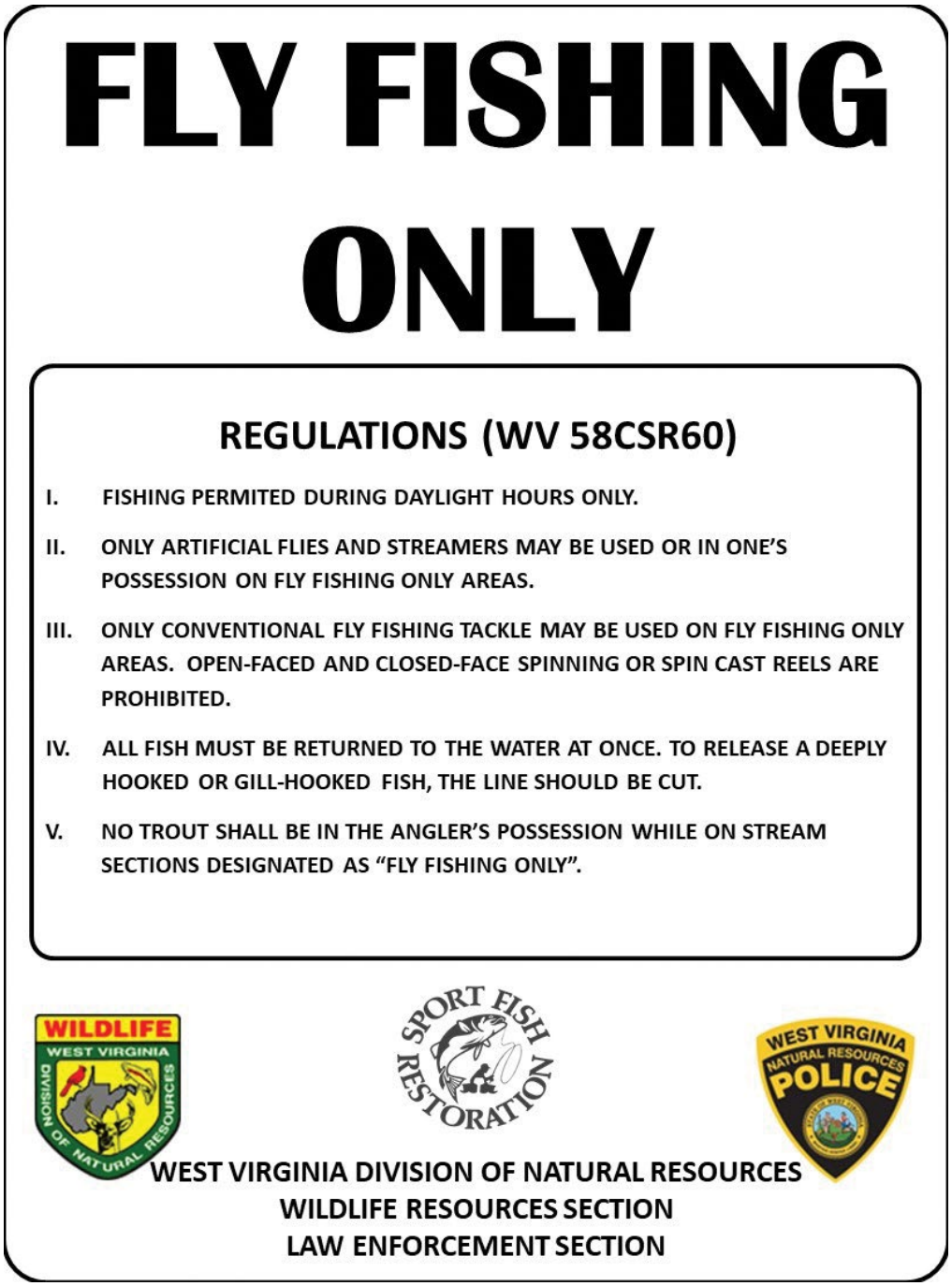


Figure 7.

Current legislated rules for Fly Fishing Only (FFO) designated trout waters in West Virginia.



Adding New Waters to the Catchable Trout Program

The WVDNR considers numerous criteria before adding waters to the trout stocking list. Some of the major criteria include stream size, flow, the existing fish community, water quality, fish habitat, access, and property ownership.

Stocked trout require adequate water flow and habitat to avoid predation and find suitable food items. Stocking small streams can add environmental stress on native fish communities and natural food supplies. WVDNR fisheries staff evaluate stream and lake communities prior to stocking any species to help protect the native fauna, endangered species, and unique genetics of trout populations. WVDNR staff must also consider water quality before stocking any fish species. Due to stream restoration and the addition of limestone, many lakes and streams throughout West Virginia can once again support aquatic communities.

Because trout require cool water temperatures (< 70°F) to survive, fisheries biologists must assess seasonal water temperatures prior to stocking trout. Although trout may be able to survive slightly warmer water, they will likely stop feeding and lose weight above 70°F. Some streams and lakes have areas of cool water that can hold trout. However, deep cool water in lakes may lack sufficient oxygen levels to support trout.

Property ownership is one of the biggest hurdles when maintaining current stocking locations and considering future locations. The WVDNR, the U.S. Forest Service, the WV State Conservation Agency, and local governments own many rivers and lakes stocked with trout. These public owned waters provide great locations for trout stocking and abundant access for anglers. However, many streams stocked throughout West Virginia are privately owned. Over the years, more landowners have posted their property, which restricts trout stocking and fishing. Usually, landowners who post their property cite poor angler ethics as the reason. Specific examples of poor angler behavior include littering, destruction of property, and vandalism. Anglers have also left gates open, which poses a threat to livestock, cut fences, and blocked driveways.

Trout stocking locations must also be safe. Many trout streams and lakes have very steep grades creating safety concerns for hatchery staff and anglers especially during inclement weather. WVDNR will not stock areas that are not safe for staff and anglers.

Suitable stocking locations require adequate parking and access for stocking trucks. Many trout waters are on narrow back roads with few areas for anglers to park. Stocking locations are more limited on private land. When West Virginia had an opening-day trout season, parking issues caused many landowners to ask the WVDNR to no longer stock on their private property.

Each year, WVDNR hatcheries produce as many trout as possible. Therefore, stocking new streams or lakes results in fewer fish available for current waters. The WVDNR must carefully consider new stocking requests to assure that hatchery-raised trout meet certain objectives and provide a popular fishery. The WVDNR is currently assessing hatchery-renovation needs to address overdue maintenance and ultimately increase trout production. Once complete, the WVDNR expects to increase stocking rates and add new waters to the trout stocking schedule.

Finally, WVDNR must consider stocking logistics. Hatchery staff strive to be as efficient as possible when hauling and stocking fish. The distribution of fish is a significant cost to the overall hatchery program. Transport trucks are very precisely equipped to safely haul trout long distances while keeping them safe and healthy. Hatchery stocking trucks often haul fish for stocking numerous streams and lakes in a single load. Tank compartments keep fish separated and the stocking staff know which sections of the trucks fish should be stocked in each water body. Hauling fish for multiple locations on a single stocking trip reduces costs by decreasing staff time and mileage. When new stocking locations are added, WVDNR seeks ways to efficiently add these waters to the stocking program.

West Virginia's Year-round Trout Fishing

Since 1966, West Virginia anglers have enjoyed year-round trout fishing with no closed season. In that year, regulations were changed to eliminate an opening day for trout fishing. At that time and again a decade later, the Division of Natural Resources assessed angler opinions of the change as well as impacts on license sales, hatchery production, recreational opportunity, and availability of stocked trout in streams and lakes. Those assessments provided strong support that the move to a year-round season was a resounding success for trout angling. After the regulation change:

- More than 75% of trout anglers favored the move to the year-round season
- The number of trout anglers increased by 30%
- Angler days spent fishing for trout more than doubled
- Trout production at state hatcheries increased by 25% because trout could be held in the hatcheries for less time and could grow faster
- More trout were available to anglers for longer periods of time after stocking
- Truck following was reduced
- Total available days of recreational opportunity more than doubled

The benefits from that important management decision continue to this day. Additional advantages from a year-round season include:

- Reduced crowding of anglers
- Increased angler satisfaction
- Reduced posting of private land at stocking locations
- Less stress on aquatic ecosystems that must support stocked trout
- Improved law enforcement coverage of the 2,048 stockings made each year

The year-round trout season is a key foundation that allows the WVDNR to provide a diversity of opportunities for trout anglers in the state. The additional management strategies identified in this plan will further build on that foundation to provide new angling opportunities. As a result, Mountain State trout anglers will have even greater freedom to select from multiple angling opportunities that interest them throughout the year.

Angler Characteristics (WVU Survey)

From April 28 to June 30, 2020, a total of 9,721 personalized emails were sent to anglers who purchased a trout stamp in the state of West Virginia in the last year. Anglers who indicated a valid email address and agreed to be contacted via email were the only ones contacted. These surveys sent via email were accompanied by two reminder emails, one after ~10 days from initial contact, and another ~20 days after initial contact. These email surveys resulted in 1,785 completed responses. This total represents 18.4% of the total number of valid individuals who were contacted. Upon receiving and opening the online survey, we collected a 93% completion rate, meaning that most of our respondents who opened the survey completed it. While the total number of completed interviews was less than what we aimed to achieve (~20% overall response rate), a sufficient sample size was obtained.

FISHING PARTICIPATION

- When choosing a place to fish, it is *moderately to very important* to anglers that the location is stocked.
- Over the last 5 years, most anglers surveyed had both a fishing license (4.5 years) and trout stamp (4.3 years) on average.
- On average, anglers fish 57 days per year in West Virginia, and 55% of the time they fish for trout.
- The majority (51%) of angler's fish more on weekends than weekdays.
- Most anglers' catch somewhere between 1–4 trout in a typical day fishing for them.
- Majority (52%) have annual household income $50,000 or more.
- Majority male anglers (66%), mean age 57 years, 11.7% veterans.

QUALITY OF FISHING EXPERIENCE

- When asked to consider how crowded it was during their typical stocked fishing experience on a 9-point scale, anglers felt that fishing locations were *slightly to moderately* crowded (5.6/9.0).
- The number of people seen by anglers when fishing for stocked trout *slightly reduced* their average enjoyment.

Angler Characteristics continued

TROUT STOCKING

- Overall, anglers rated the quality of the trout stocking program in West Virginia as *average to good*.
- Regarding stocking schedules, anglers rated "unannounced stockings" as *somewhat favorable*.
- The quality of the "Gold Rush" stocking program was rated as *fair/average* and given an estimated value of *$55 per experience*.

COVID-19 IMPACTS ON ANGLING

- The majority of anglers (53.2%) spend most of their time continuing to fish at their usual fishing areas in light of the COVID-19 pandemic, although some (18.4%) have not gone fishing since the outbreak.
- A large portion of respondents (44.0%) have reduced the number of fishing trips they take due to the pandemic.
- About a third of anglers are reporting seeing more anglers than they had expected to see due to COVID-19 (36.8%), with another third seeing less anglers than expected (33.1%).

Overview and Description of Hatcheries

West Virginia fish hatcheries and fish stockings began in the late 1800s, but it wasn't until the 1950s that larger hatcheries were built and fish production and stocking began to increase. The purpose of the WVDNR hatchery program is to provide fish for recreational angling opportunities. Without the hatchery program, many of the state's waters would not sustain recreational sport fishing at the current level. This is especially true for most stocked trout waters due to increased temperatures during summer months.

The WVDNR currently manages and operates seven trout hatcheries statewide. These hatcheries include Bowden, Edray, Petersburg, Reeds Creek, Ridge, Spring Run and Tate Lohr. Hatcheries are distributed mainly along the eastern mountain counties and associated large springs (Figure 1). These coldwater hatcheries rear trout species including Rainbow Trout, Golden Rainbow Trout, Brook Trout, Brown Trout, and Tiger Trout. Annual production from all these WVDNR hatcheries averages more than 1 million fish per year. Each facility has not only close distribution responsibilities, but also statewide responsibilities, which comprise more than 200 waters. It is not uncommon for staff to drive 12-hours round trip to a location. Due to aging facilities, the agency has implemented capital improvements to either upgrade or rehabilitate facilities.

Spawning and Growth

Several of the hatcheries culture and maintain their own brood stock for spawning. After spawning, eggs and fingerling trout are provided to the remaining hatchery facilities for grow-out. Rainbow and Golden Rainbow Trout are spawned starting in August with Brown and Brook Trout spawned in September and October, respectively. Brood fish are given an anesthetic to keep them calm during the egg and milt collection process. Trout eggs are hatched indoors and grown to fingerling size prior to moving to outside pools and/or raceways. Fingerling trout are moved outside after raceways and pools have been emptied and sanitized upon completion of the spring stocking season. Fingerlings are then reared to catchable size for the following spring stocking, although some are distributed to provide a wild fishery. At the time of stocking, most catchable sized trout are 1.5 years old with a target weight of ¾ pound. Additionally, surplus brood stock is generally acquired from the White Sulphur National Fish hatchery and distributed by state facilities. Additional information provided in Table 5.

Hatchery trout are fed a special pelleted diet, which changes in formulation and size, as the fish get older. Very young fish are fed a diet high in fat and protein content and the concentration of several ingredients decrease as fish grow. Trout food is the single most costly item purchased by the hatchery program.

In recent years, the hatchery program has added carotene pigments to the trout diets. These pigments are naturally eaten by wild fish and are present in the external casings of insects. This natural consumption of carotene pigments can be seen by the brilliant colors on the skin and in the flesh of our state native Brook Trout populations. Due to the addition of carotene pigments in the trout diets, most stocked trout have more brilliant skin and flesh coloration than was historically observed by anglers.

Fish Health and Biosecurity

Fish health in a hatchery is extremely important and several techniques are used to ensure a healthy fish and environment. Biosecurity in a hatchery environment can be defined as the practices that minimize the risk of introducing or spreading biological, chemical or physical agents. In a hatchery environment, there are specific practices (preventative and active) that reduce the transmission of pathogens and diseases within the hatchery. These practices are also implemented to prevent the spread of disease to locations outside the hatchery. Examples of biosecurity practices are disinfection of brooms, nets, boots, floors and using separate equipment for each rearing tank. Wildlife that predates on the fish also create biosecurity threats by either introducing or transferring unwanted disease between rearing units. Transferring eggs and fish from one facility to another and distribution of fish to lakes and streams can also create biosecurity concerns. Each facility has unique qualities; therefore, a variety of these biosecurity protocols are applied. The WVDNR is currently in the process of initiating a system wide biosecurity program.

Fish health analysis plays a very important role in hatchery production. On-site, daily fish observations are conducted to assist in early detection of a disease outbreak. Each facility has at least one individual who conducts lab analysis on a regular basis, which consists of collecting morbid fish for microscopic of pathogens. If pathogens are detected, corrective treatments are conducted. For a more descriptive fish health analysis, fish samples are shipped to certified analytical labs for bacteriology and virology. If bacterial infections are detected in fish health analysis, appropriate medicated feed can be used to help eliminate the bacterial pathogen.

Fish samples from each hatchery are shipped to a certified lab for thorough analysis on an annual basis as part of a long-term fish health-monitoring program. The results of the annual analysis provide insight into overall fish health within the program and to outside agencies that may want to share surplus fish inventory.

Husbandry practices rely on stringent production procedures. Unclean rearing units are ideal breeding grounds for pathogens, and result in increased ammonia levels and decrease oxygen levels. Daily and weekly cleaning of rearing units is conducted to reduce sediment and provide a cleaner environment. Careful calculation of feed volume provides optimal growth while reducing waste products and maintaining a clean environment.

Water quality and temperature is possibly the most critical aspect to fish health. Trout are coldwater species and require clean cold water. Most WVDNR facilities have spring-fed water sources which provide optimal 54-degree temperatures, however, some of the facilities combine spring-fed with river sources. During winter conditions, springs can have low flows due to lack of snow melt, while river temperatures reach near freezing. Extremely cold water temperatures from river sources reduce trout metabolism, therefore decreasing appetite and growth. Summer conditions result in low coldwater spring flows and warm river temperatures. Warm water from river sources can decrease dissolved oxygen and increase parasitic activity on fish. During warm, low-flow conditions, feeding rates are lowered to reduce waste buildup in rearing units and to decrease oxygen consumption by the trout. In many cases, daily fish health treatments are needed and additional aeration is needed in the fish rearing units. Lastly, muddy water conditions in river sources create a variety of problems ranging from sediment buildup in rearing units, lack of feeding, and the onset on some diseases especially in fish gills.

Table 5.

Description of total trout production (2018 - 2020) at WVDNR trout hatcheries.

Facility	Location	Species Spawned	Species Incubated	Species Reared	Total Production		Total Distributed	
					Poundage	Number	Poundage	Number
Bowden	Elkins, Randolph County		Rainbow Golden Brook Brown	Rainbow Golden Brook Brown Tiger	638,507	1,021,252	427,935	769,676
Edray	Marlinton, Pocahontas County		Brown Tiger	Rainbow Golden Brook Brown Tiger	68,710	231,889	454,389	675,905
Petersburg	Petersburg, Grant County	Rainbow Golden	Rainbow Golden	Rainbow Golden Brook Tiger	99,880	117,012	168,389	185,563
Reeds Creek	Upper Tract, Pendleton County	Rainbow Golden Brook Brown Tiger	Rainbow Golden Brook Brown Tiger	Rainbow Golden Brook Brown Tiger	532,127	754,737	304,481	422,990
Ridge	Berkeley Springs, Morgan County	Brook	Brook	Rainbow Golden Brook Brown	164,017	199,810	188,705	222,573
Spring Run	Dorcus, Grant County			Rainbow Golden Brook Brown Tiger	647,084	804,083	369,581	451,557
Tate Lohr	Princeton, Mercer County			Rainbow Golden	18,552	38,898	281,126	447,807
White Sulphur	White Sulphur Springs, Greenbrier County				25,729	8,390	0	0
				TOTAL	**2,194,606**	**3,176,071**	**2,194,606**	**3,176,071**

Program Description

A formal program exclusively for native and wild trout management in West Virginia does not exist. The Coldwater Fisheries Biologist has traditionally been the steward and manager of the native and wild trout resources of the state along with the responsibilities of overseeing the management and operations of the coldwater hatcheries. A restructuring of the Fisheries Management Unit in 2015 led to changes allowing a more focused effort on native and wild trout management by the Coldwater Fisheries Biologist. The Coldwater Fisheries Biologist is generally expected to monitor populations of native and wild trout for changes in distribution, abundance, and health throughout the state. This monitoring is accomplished with periodic electrofishing surveys, angling, and discussions with the angling constituency. Anecdotal information from anglers plays a key role in determining annual priorities for qualitative and quantitative stream surveys.

District Fisheries Biologists often support the Coldwater Fisheries Biologist with some management activities such as electrofishing surveys and fingerling trout stockings, but that support is largely discretionary as available time and prioritization of objectives permits. The Coldwater Fisheries Biologist works closely with other professional biologists within West Virginia and beyond to maintain a broad context for the health and well-being of the valuable native and wild trout fisheries.

The U.S. Forest Service (USFS) Fisheries Biologists on both the Monongahela and George Washington/ Jefferson National Forests know their coldwater fisheries intimately and contribute information to the WVDNR to aid in appropriately managing the fisheries and waterways in their administrative areas. The Watershed Branch of the WVDEP is another key partner in acquiring data to better understand the status of trout waters and their fish populations. The WVDEP also has the regulatory responsibility for the quality of all State waters and their ability to sustain aquatic life. Native and wild trout presence in these waters is assigned the highest levels of environmental protection. Partnerships for monitoring and assessing trout waters are not restricted to agencies. Trout Unlimited has a large professional staff presence in the state and works closely with public and private landowners for the improvement of riparian and in-stream habitat for the conservation of native Brook Trout. Faculty and staff of West Virginia University and the USGS Fish and Wildlife Cooperative Research Unit have long partnered with the WVDNR to address research priorities and habitat restoration and enhancement for coldwater fisheries, including native and wild trout.

Distribution

Wild trout populations are native, have been naturalized, or are expected to occur in 30 of the 55 counties in West Virginia within WVDNR Districts 1 through 5. Only District 6 does not have the cold waters or steep, rushing mountain streams for trout to thrive.

BROOK TROUT

Brook Trout are the only member of the Salmonidae family of fishes native to West Virginia. Their natural historic range is unclear, and while they likely occupied many more habitats than those in which they currently exist (Hudy et al. 2008), it is unlikely they existed in any of the major watersheds outside of where they remain today. Vague distribution maps of the past (MacCrimmon and Campbell 1969; Behnke 2002: p. 278) exhibit a range substantially farther westward and without any discernible watershed boundaries compared to the current understanding of their natural history and distribution in West Virginia. Their native distribution in West Virginia is known from the Monongahela, Chesapeake Bay, and Kanawha/ New (upstream of Kanawha Falls) drainages (Table 6, Figures 8 and 9). The pre-settlement status of Brook Trout in the Elk River, flowing to the Kanawha River in Charleston, is unclear. They may have been introduced by man at some earlier time and then became naturalized. The WVDNR regards them as native; a current hypothesis is that they likely migrated into the Elk drainage from the Tygart Valley River headwaters sometime in the last 10,000 years via the complex underground karst network that connects the two watersheds.

There is not a lot of literature specific to Brook Trout distribution and dispersal history in West Virginia, though there is substantial documentation of the geologic mechanisms that formed the landscape, its rivers, and the dispersal pathways for fishes into the waters of the state (Jenkins et al. 1972; Hocutt et al. 1986; Stauffer et al. 1995). The historical extent of native Brook Trout in West Virginia appears to have been established by the multiple advances and retreats of glaciers during the Pleistocene Epoch (11,700–2.58 million years ago). While glaciers never reached present-day West Virginia, the leading edge of glaciation changed the direction of major waterways, creating vast inland lakes that flooded the ancient Teays (present-day Kanawha/ New River) and Pittsburgh (present-day Monongahela) rivers. Glacial advance also created longer cold seasons allowing for the migration, survival, and colonization of Brook Trout into present-day West Virginia. With the retreat of the last glaciers and subsequent reduction in coldwater habitats, Brook Trout remain in only the most mountainous regions of the state and in those areas with sufficient groundwater sources to maintain cold, continuous stream flows (Figure 10). Stream capture, or river piracy, is also well-documented across the Central Appalachian landscape and has continued to shape the natural distribution of Brook Trout in West Virginia since the end of the Ice Age.

Table 6.

Current distribution and status of trout populations within the major drainages in West Virginia.
Suitable habitat in the unidentifiable sub-basins is rare and trout populations are absent.
N=native; RN=regarded native; I=introduced; S=stocked.

MAP ID	HUC8 SUBBASIN NAME	HYDROLOGIC UNIT CODE - 4TH LEVEL	Brook Trout	Brown Trout	Rainbow Trout
1	South Branch Potomac River	02070001	N	I	I
2	North Branch Potomac River	02070002	N	I	S
3	Cacapon River	02070003	N	I	S
4	Potomac River drains	02070004	N	S	S
5	North Fork Shenandoah River	02070006	N		
6	Shenandoah River	02070007	N	S	S
7	James River	02080201	N	S	S
8	Tygart Valley River	05020001	N	I	S
9	West Fork River	05020002		S	S
10	Monongahela River	05020003		S	S
11	Cheat River	05020004	N	I	I
12	Lower Monongahela	05020005		S	S
13	Youghiogheny River	05020006	N	I	S
14	Upper Ohio River 1	05030101		S	S
15	Upper Ohio River 2	05030106		S	S
18	Little Kanawha River	05030203	I	I	S
19	Upper New River	05050002	N	I	I
20	Greenbrier River	05050003	N	I	I
21	Lower New River	05050004	(I)	I	S
22	Gauley River	05050005	N	I	I
23	Upper Kanawha River	05050006		I	S
24	Elk River	05050007	RN	I	I
26	Coal River	05050009	(I)	I	I
27	Upper Guyandotte River	05070101	I	I	I
29	Tug Fork River	05070201	(I)	I	I

Figure 8.

Distribution of Brook Trout in West Virginia.

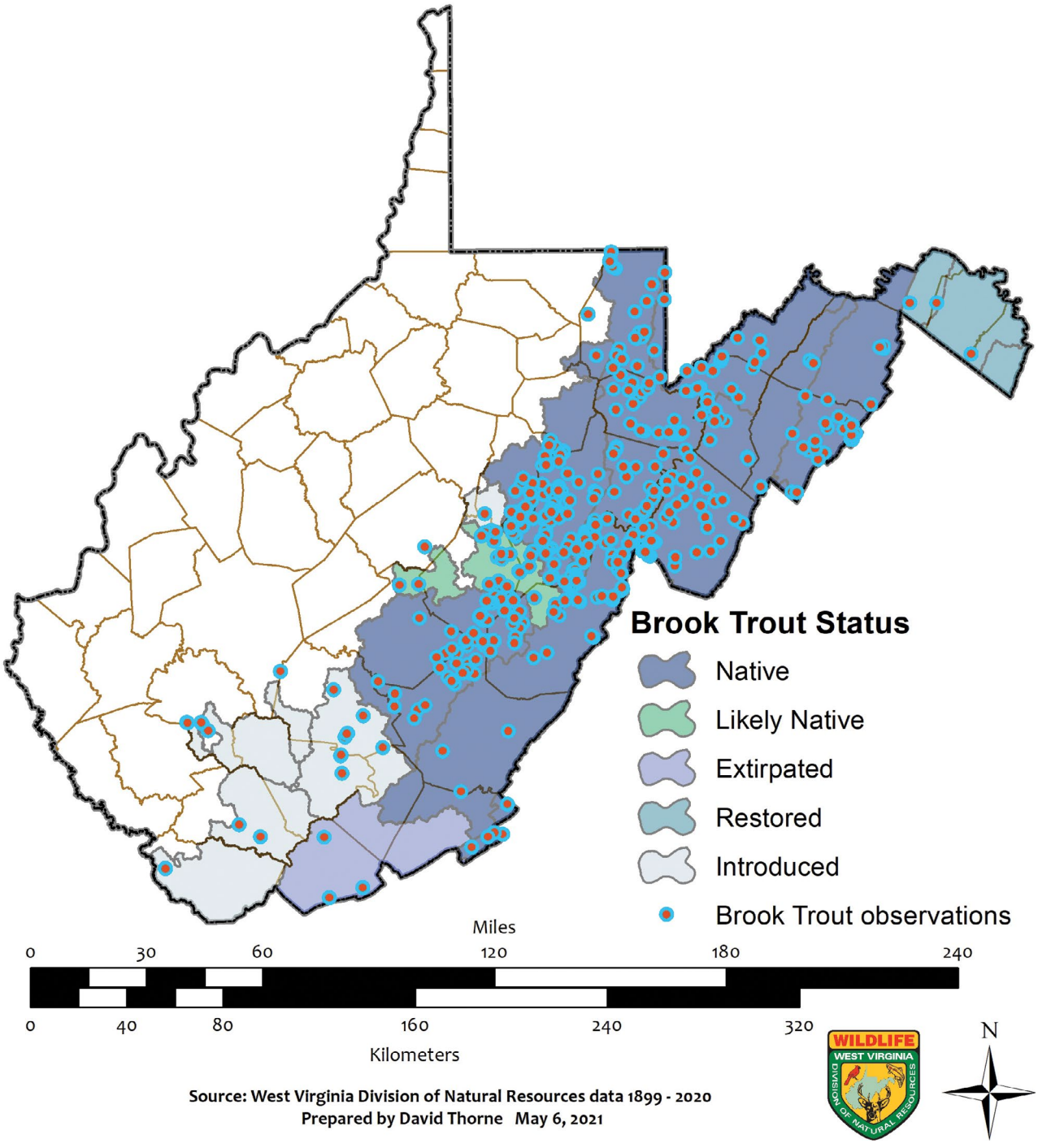


Figure 9.

HUC8 sub-basins in West Virginia. Reference index can be found in Table 6.

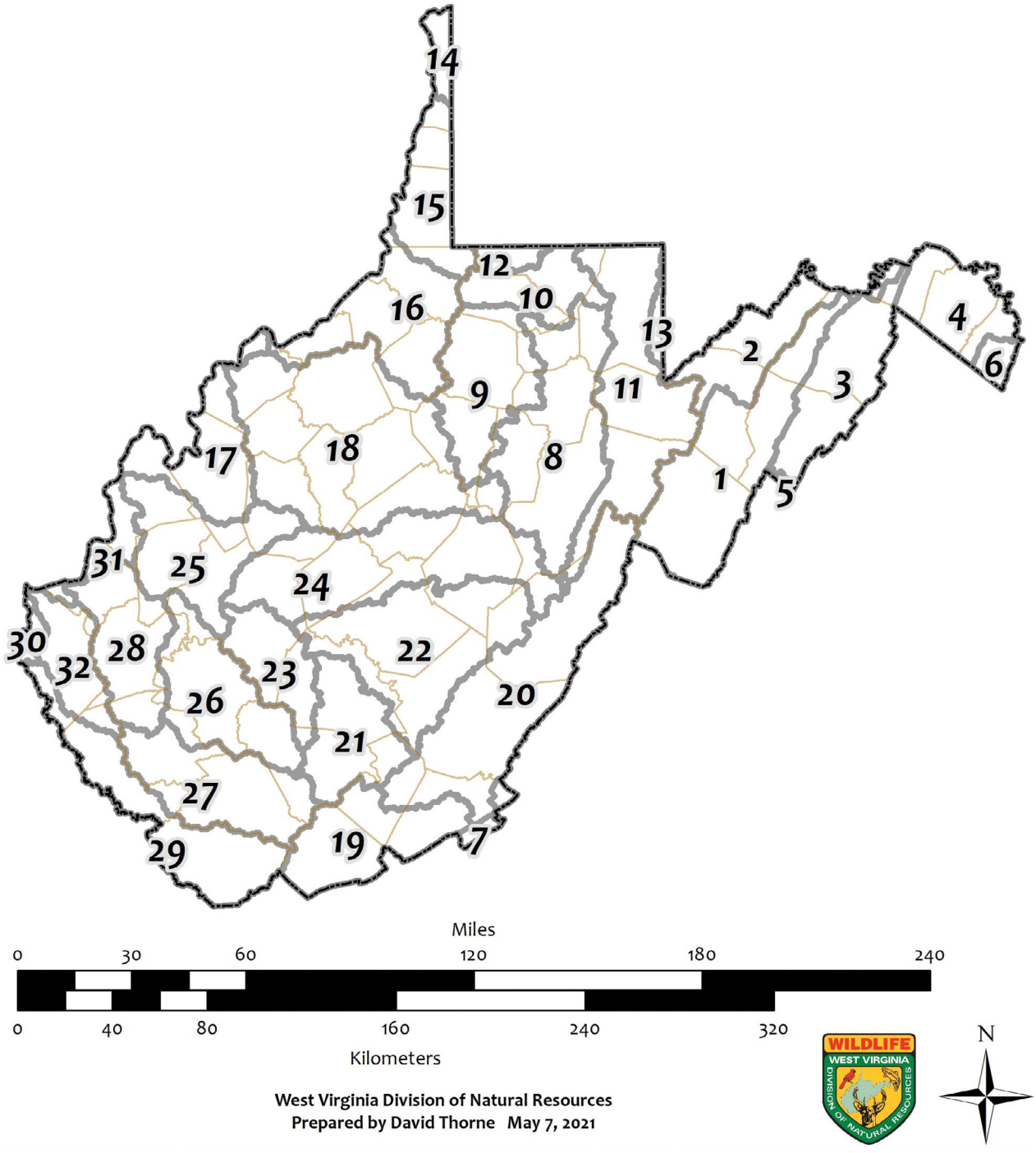
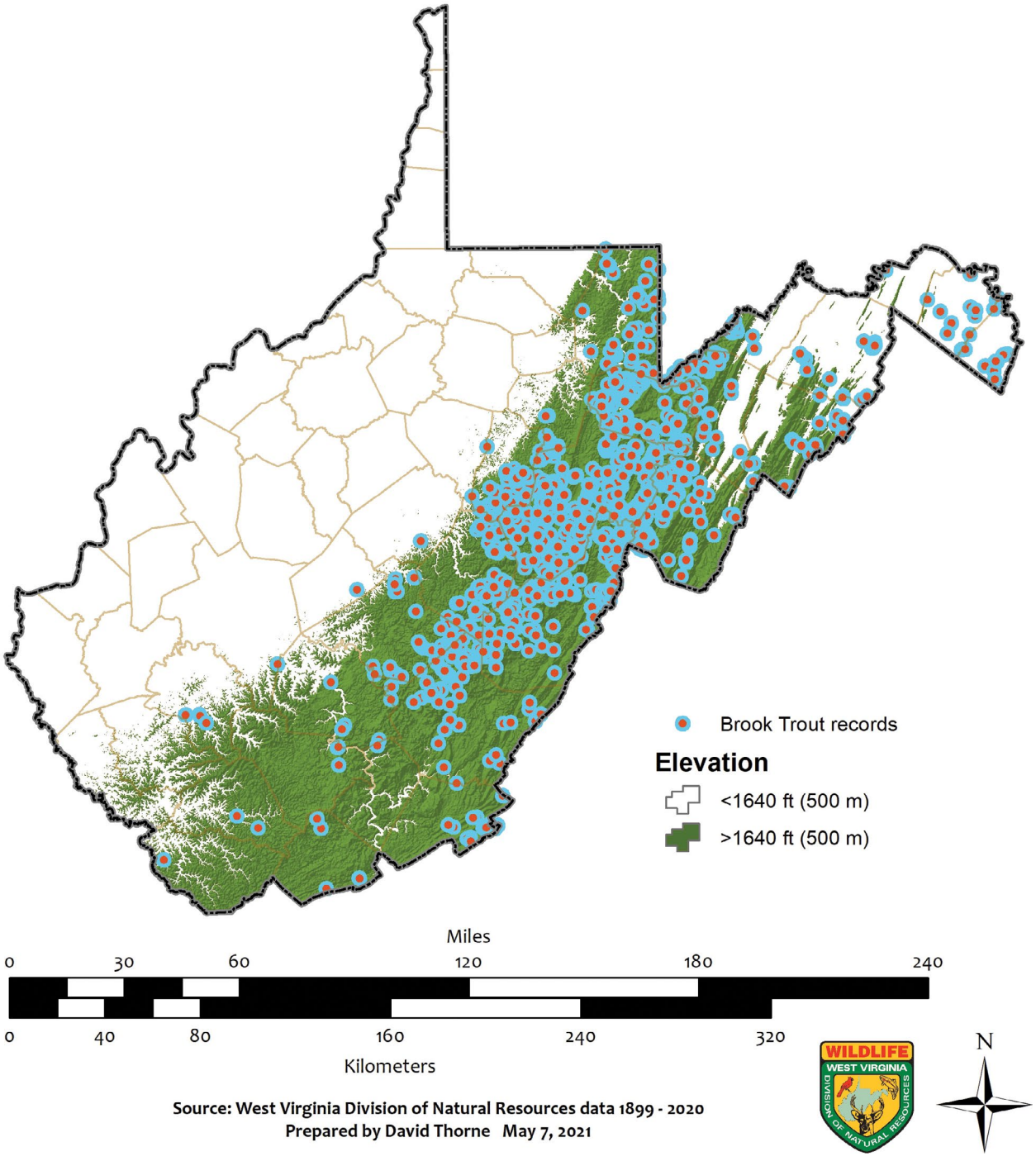


Figure 10.

Visual Relationship of Brook Trout occurrence and elevation greater than 1640 feet (500 meters) in West Virginia.



Distribution continued

Brook Trout are not considered native to the tributaries within the New River Gorge. While habitat is often ideal and stream temperatures are adequate, the pathway for Brook Trout to have colonized the steep gradient streams up and over waterfall barriers is not apparent. Given the ancientness of the gorge predating the Brook Trout's rise as a species, the lack of any literature noting their presence, and the absence of surviving relict populations, it is unlikely they ever occurred with any abundance in waters downstream of the Greenbrier River.

BROWN TROUT

Brown Trout are the most warm-water tolerant of the trout found in West Virginia and wild populations of them can be found in places that are no longer habitable by the native Brook Trout (Figure 11). Brown Trout are often sought by anglers for their wariness which, along with a longer life span, leads to older and bigger adults, often more than 20 inches in length. They have been known to hold over and occasionally reproduce in many streams and rivers where they have been stocked. But thriving sustainable populations are rare, and the best populations are in some of the karst spring creeks of the Greenbrier Valley, Williams River headwaters, Elk River headwaters and tributaries, upper Shavers Fork, Gandy Creek, Dry Fork, and Blackwater River. One of the most notable wild populations has been established in Elkhorn Creek, where they were introduced in the early 1990s and have thrived (Reed 1998).

The original Brown Trout in the United States came from Germany ("von Behr" trout) in 1883. Later, others were imported from England and Scotland (Loch Leven trout) (Behnke 2002: pp. 255-256). The earliest imports were reared in New York and Michigan and distributed into waters local to those areas. It is unclear when the first Brown Trout were introduced into West Virginia waters, but it was likely within ten years of their arrival in the United States, as they were stocked into Pennsylvania by 1886 (Cooper 1983: p. 66).

Establishment of wild Brown Trout populations is dependent on good water quality, adequate spawning habitat and substrate, and access to cold water for refuge during warm seasons. Typically, this habitat occurs in reaches downstream of, but too warm for year-round occupancy by, native Brook Trout populations. However, some of the best wild Brown Trout populations in the state occur in the southern coalfield counties where low-sulfur coal has been mined and the water discharges emanating from the mines are cold, clear, consistent, mineral-rich, and free of limiting toxins.

RAINBOW TROUT

Rainbow Trout have similar habitat and stream temperature requirements as the native Brook Trout. Some very good wild Rainbow Trout populations exist across the range of trout waters in the state and provide popular and excellent destination fisheries (Figure 12). The tendency for Rainbow Trout to leap when hooked makes them prized by anglers, and their longer life span allows them to reach a larger size in the right habitats. Some of the better-known wild Rainbow Trout waters in West Virginia are Seneca Creek, Shavers Fork headwaters and tributaries, Elk River headwaters and tributaries, Spring Run, and Elkhorn Creek. There are many small streams scattered across the state that support wild Rainbow Trout that do not achieve a much greater size than would be expected from native Brook Trout in the same system.

Rainbow Trout have been widely cultured across the country since fertilized eggs and fry could be transported from their native habitats. By 1877, Rainbow Trout (among other species) were being imported and stocked into West Virginia waters (Kinney 1963). It is unknown if any of these earliest efforts created any of the wild fisheries we now know. However, the use of the railroads to transport trout eggs and fry from U.S. Fish Commission hatcheries in California into and throughout West Virginia likely did play a role in the establishment of some of our known wild Rainbow Trout fisheries. A direct rail connection was completed by 1917 from Elkins to Bergoo. This railway follows Shavers Fork from Bowden to Spruce before crossing Cheat Mountain and descending to Bergoo along the length of the Elk River and parts of Big Spring Fork. It is about this time, according to the logbook at the Cheat Mountain Club, that Rainbow Trout were introduced into the Shavers Fork. It is also about the same time that Rainbow Trout began appearing in the Elk River and its tributaries (Byrne 2007). To this day, mainstem and many tributaries of both the Elk and Shavers Fork continue to harbor populations of wild Rainbow Trout, likely initiated by these efforts of the U.S. Fish Commission and early State fisheries experts. Provenance of other wild Rainbow Trout populations is even more vague. Seneca Creek, for example, is perhaps the best known of West Virginia's wild Rainbow Trout streams, and with good reason. It is a top-rate fishery and has been for generations of anglers. But the establishment of the wild Rainbow Trout fishery there does not lend itself to a hypothesis like the Elk and Shavers Fork populations. Seneca Creek was stocked regularly by the precursors to the WVDNR into the 1970s, but the wild Rainbow Trout population was already well established and well known to biologists and anglers long before stocking ceased in favor of the wild fishery. Spring Run likewise has a long history as a wild Rainbow Trout fishery, as evidenced by the information passed down through the years. Jerry Burke, previous owner and steward of the Spring Run property now

Figure 11.

Distribution of Brown Trout in West Virginia within the major drainage basins (HUC8).

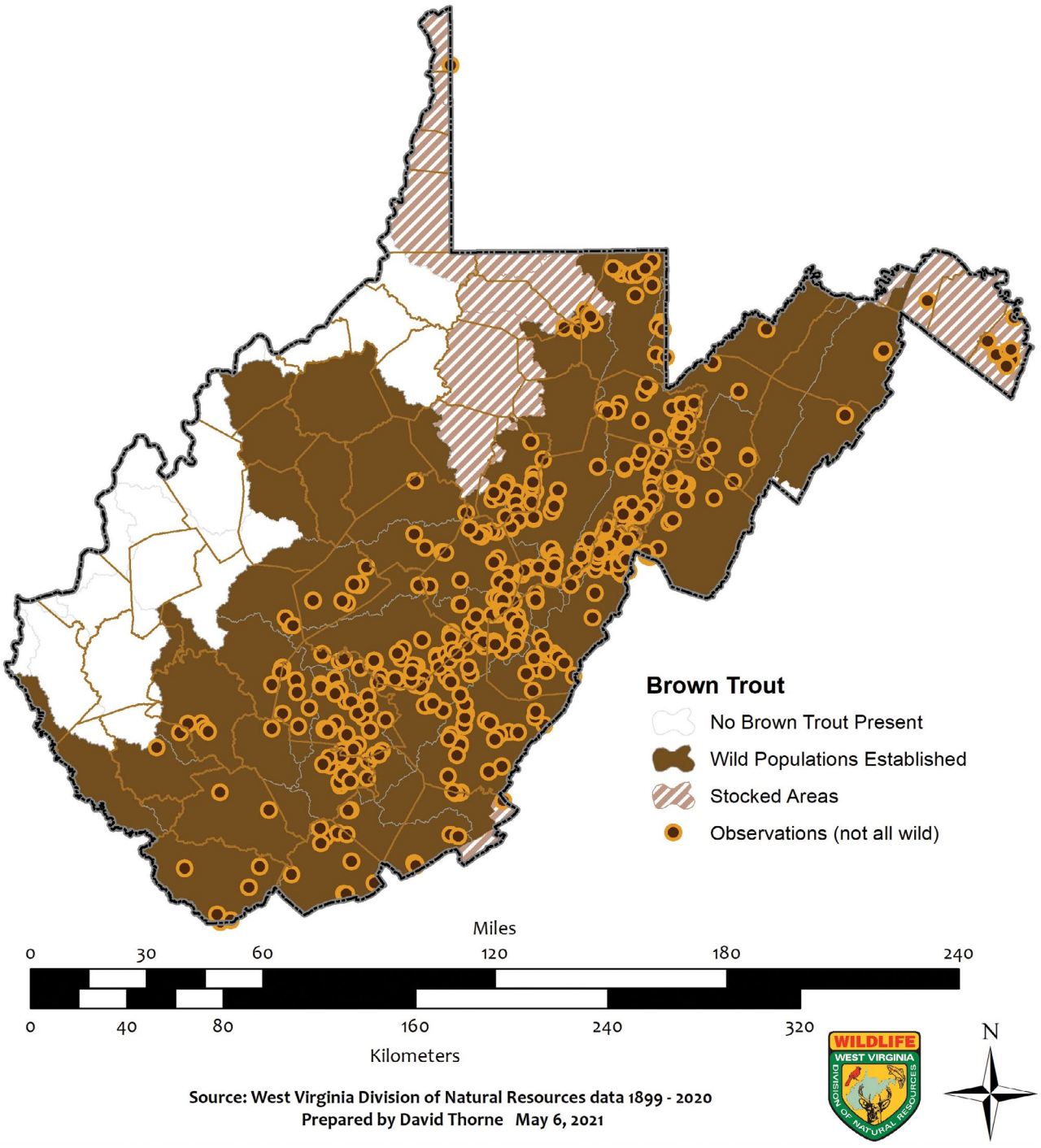
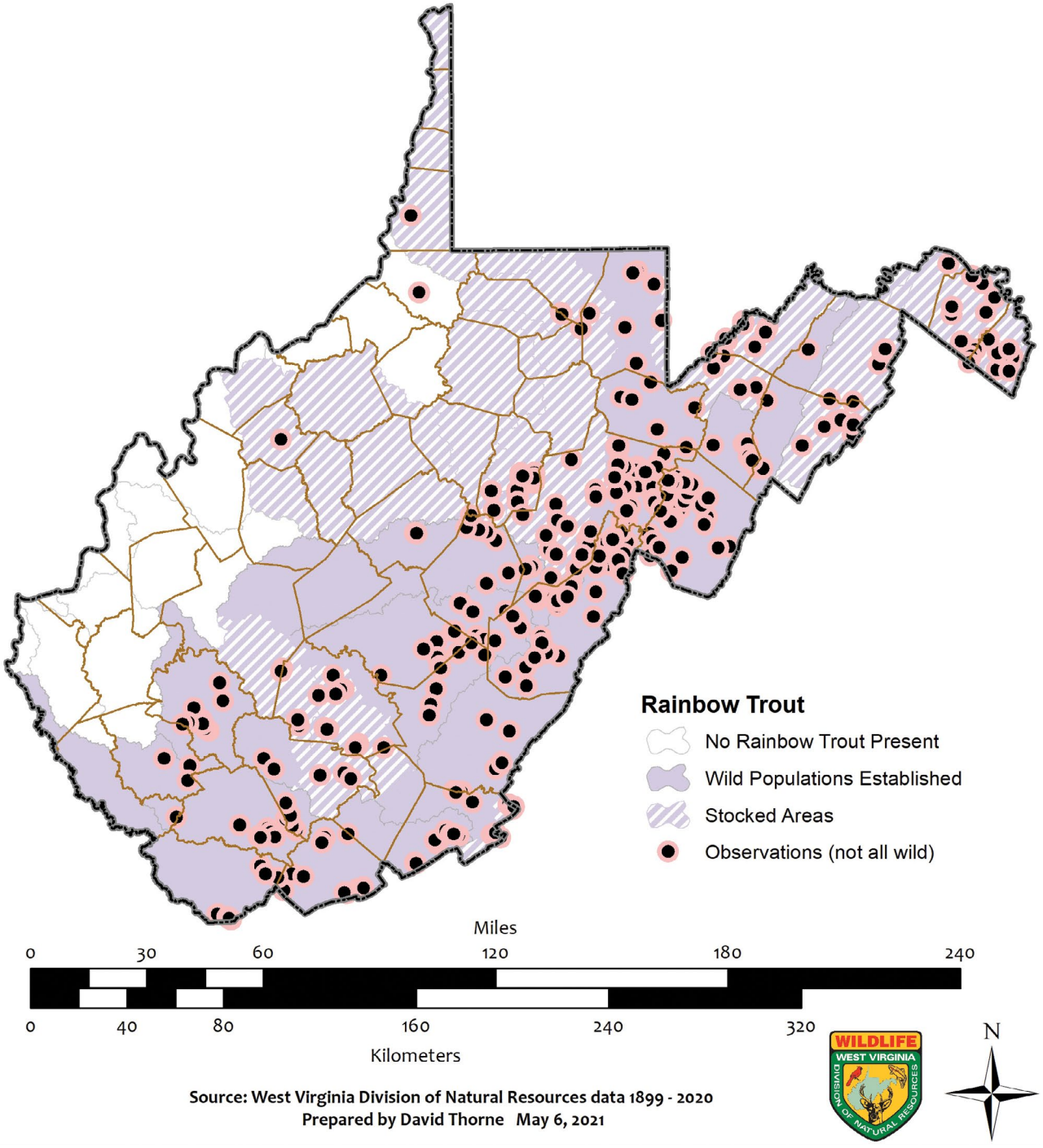


Figure 12.

Distribution of Rainbow Trout in West Virginia within the major drainage basins (HUC8).



Distribution continued

under WVDNR ownership and management, has a photo dated "early '20s" showing three local men with a stringer of 35 fish—all Brook Trout. The man from whom Burke received the photo reported Brook Trout being replaced by Rainbow Trout by 1930. Other testimonials report that in the 1940s Spring Run was a Rainbow Trout stream. It is apparent from these observations that Spring Run was already a wild Rainbow Trout stream well before the Spring Run Trout Hatchery was completed in 1952 (Burke 2008).

Ecology

Stream ecologists and managers regard native and wild trout fisheries as indicators of properly functioning cold-water systems that are important recreational fisheries to anglers. In West Virginia, cold-water ecosystems are represented by streams and small rivers as well as associated springs and beaver ponds. Native and wild trout are typically the dominant predatory fish in the ecosystems where they occur. The presence and long-term persistence of native or wild trout populations in a stream indicates that the necessary physical, biological, and chemical features of the ecosystem are intact and functioning in a relatively healthy manner. The absence of native or wild trout in streams where they would be expected usually indicates that one or more of these features are not functioning properly.

The three species of trout found in West Virginia have similar ecosystem functions although some variation exists due to differences in behavior and life history. Native and wild trout populations are the healthiest when habitat is abundant and well connected. Ideal habitat includes an abundance of deep pools with in-stream and overhead cover, stable stream banks with mature trees to hold soil and shade the stream, low amounts of fine sediment in spawning gravels, consistently cold water, and the absence of water chemistry stressors such as pollutants or acidity (Raleigh 1982; Hartman and Hakala 2006; Fayram and Mitro 2008).

REPRODUCTION

Wild trout typically spawn in cold, well-oxygenated streams with gravel bottoms. These conditions are more likely encountered higher in a watershed; trout will typically move upstream into these areas prior to spawning. Brook, Brown, and Rainbow Trout usually do not perform the long-distance migrations seen in anadromous salmon and steelhead cohorts, but movements of hundreds of feet to a few miles are common and these small migrations can be critical to reproductive success. Brook Trout also have a strong preference for spawning in areas of ground water upwelling of springs in stream bottoms. Wild Brook and Brown Trout spawn in the fall (September to November), while wild Rainbow Trout typically spawn in the spring in West Virginia (February to April), although some descendants of recent hatchery stocks continue to be fall-spawning fish. The females are the first to initiate spawning behavior, seeking out an appropriate site for her gravel nest, or redd. Males soon follow and begin courting females, driving off other potential suitors. The male ultimately stimulates the female to spawn and then leaves her. She then covers the fertilized eggs with fine gravel and moves on to create a new redd for another potential brood.

Age at sexual maturity may vary among the three species and among populations, with males usually maturing before females. All three species may mature as early as one year of age, but typically mature at age two. Newly hatched trout remain in the sanctuary of the redd feeding off energy reserves from their yolk sac until forced to leave the redd to seek prey. Brook and Brown Trout fry will emerge from the redd sometime between February and April. While Brook and Brown trout remain in the redd over the winter, Rainbow Trout usually emerge after only a few weeks due to warming water temperatures in the spring. Young trout seek shelter in shallow water areas along the stream banks where larger fish cannot prey on them, flows are calmer, and smaller prey is more abundant.

Ecology continued

DIET

Trout are opportunistic sight feeders, taking prey such as macroinvertebrates in both larval and adult form, terrestrial insects, and when they are larger they will feed on fish, crayfish (Petty et al. 2014) and even small mammals. As sight predators, feeding and growth may be impaired by decreased water clarity from sedimentation (Sweka and Hartman 2001). Healthy aquatic habitat provides a greater variety and abundance of food sources, ensuring adequate prey is available throughout the year.

TEMPERATURE

Water temperature not only limits the places where native and wild trout can occur, but exerts strong regulating pressures upon development, survival, growth, and reproductive success. Therefore, temperature influences their role in the ecosystem (Wootton 1998). As temperature increases within a natural aquatic system, there is an increase in the ability of the water to produce food. The primary base of the food chain in mountain streams is organic material such as leaves and wood entering the stream from the surrounding forest (Dolloff and Warren 2003). These items are broken down and consumed more rapidly by microbes and macroinvertebrate organisms as stream temperature increases. However, there is a trade-off to this increase in food supply. As temperature increases, the amount of dissolved oxygen (DO) in water decreases, affecting all life stages of wild trout (Power 1980). Those individuals or species able to adapt to temperature and DO fluctuations in dynamic streams systems are better suited to hold a competitive edge throughout their life cycle.

COMMUNITY ECOLOGY

Prior to large-scale landscape disturbances by humans that reduced the range of Brook Trout in West Virginia, their ecological role was likely more varied in the state. Predatory fish, such as trout, act as a keystone species, shaping the community of organisms in which they live. In historic conditions with better habitat, water quality, and stream temperatures, their abundance, average size, and maximum size were much greater than is currently the case (Zurbuch 2015). It is also likely that greater variation in the life history of wild Brook Trout occurred in the past, with larger fish occupying larger stream systems with movement in and out of tributaries (Petty et al. 2005). Currently, nonnative trout, especially Brown Trout, may occupy this role in some West Virginia streams, but our understanding of the differences between existing fisheries and historic fisheries is incomplete.

Wild trout historically and currently do not exist in isolation in streams and must compete for resources with each other and with other fish species. In many stream systems, they may be important prey for mammals, birds, and reptiles. Since water temperature generally increases proceeding downstream in a river system, there is typically a transition zone where trout overlap and are then replaced by more warm-water tolerant fish such as Smallmouth Bass, Muskellunge, or Walleye. Minor shifts in water temperature can play a large role in one species having a competitive advantage over another. For instance, Brook and Brown Trout in the same stream with Creek Chub, a major nongame competitor, show a major shift in advantage between species as temperatures increase. At 68°F, the two trout species are equal but superior to Creek Chub. By 72°F, Creek Chub begin to outcompete Brook Trout and by 75°F the Creek Chub begin to outcompete Brown Trout (Taniguchi et al. 1998).

Small trout may be prey for nongame fish that they, in turn, may prey upon as they transition into larger adults. The presence of trout in the stream ecosystem creates a strong cascade effect down the food chain, affecting crayfish, salamanders, insects, and even algae densities in the stream (Tzilkowski 2005). These interactions are complex and often prevent any one species from becoming overpopulated with individuals of decreased fitness. For example, while trout feed on crayfish, the crayfish feed on fish eggs (Dorn et al. 1999). Many anglers believe that beavers reduce trout populations. In many instances, however, the results of beaver activity may increase opportunities for trout foraging on prey fish, increasing individual trout growth. Furthermore, beaver ponds store sediment and may increase stream flows during droughts. Viewing the watershed holistically, the presence of beaver may improve conditions for trout in one location at the expense of another (Majerova et al. 2015). Beaver and Brook Trout have coexisted in West Virginia streams for millennia and while their interactions are complex, beaver should not be viewed as impairing Brook Trout populations at the larger scale.

The greatest controls on our wild trout populations are related to available habitat, the stability of that habitat, water chemistry, competition, and the effects of floods and droughts (Roghair et al. 2002). Trout populations are heavily dependent on stable stream flows that reduce water temperature and predation, but extreme floods move streambed materials in a violent manner that often injures or kills trout. Extreme flood events often cause increased mortality of many of the largest trout in the stream as well as the young-of-the-year. In fact, an entire year of reproduction may be destroyed during extreme flooding (Carline and McCullough 2003).

Genetics

BROOK TROUT

Population genetics of a species are formed by the connection and dispersal of individuals across a landscape over time. Fishes are dependent on connected riverine systems and Brook Trout require these systems to be cold for extended periods of the year for migration. Major Appalachian drainages have been connected, disconnected, and reconnected multiple times since the beginning of the Quaternary Geologic Period (~2.5 million years ago) (Hocutt et al. 1986). Brook Trout diverged from their ancestors much earlier during the late Miocene Epoch (~5 to 10 million years ago) (Power 2002), have lived in the area that is now West Virginia for at least the last 250,000 years, and have been evolving with the landscape continuously over that time. This has allowed for a wide range of genetic diversity within the species. That diversity has been described yet continues to be refined. Much of the current work on native Brook Trout genetics helps describe the connectedness or relatedness of populations (Kazyak et al. 2022), allowing fisheries managers to make better decisions about conservation and restoration activities. Most of the genetic work in West Virginia has been focused on the Eastern Panhandle, or that portion of the state that is part of the Chesapeake Bay drainage, due to its context within the regional discussions about Brook Trout conservation. But most of West Virginia's populations exist within waters flowing to the Ohio river basin, via the streams and rivers flowing to the Monongahela River of the north and those flowing south and westward into the New and Kanawha Rivers.

There has been much concern within the conservation genetics community that past and current stocking of hatchery-bred Brook Trout has introduced inappropriate characteristics into local wild and native populations. Researchers are finding in multiple studies, however, that there is little evidence of introgression of non-local genetics (hatchery-bred strains) into local native stocks (Kruger and Menzel 1979; Annett et al. 2012; Kazyak et al. 2018; White et al. 2018; Bruce et al. 2019; Morgan et al. 2021). Most of these studies have been conducted in robust populations in good habitat. Consideration must be given to reducing impairment of populations that may be small and under stressful environmental pressures. For example, in South Carolina comparatively high introgression of hatchery stock into wild populations (Pregler et al. 2018) has been documented due to the severely fragmented nature of the limited appropriate coldwater habitats that occur there.

Using genetic tools as a guide to manage Brook Trout populations can be difficult. On one hand, the knowledge of the status and health of populations is important and understanding genetic diversity is necessary to ensure long-term fitness and sustainability. But the detailed information from emerging techniques can describe populations as ever smaller unique units that can be impossible to manage or maintain with a rational level of effort. Choosing an appropriate landscape scale to assess and manage populations has become the biggest challenge to managers, because each watershed and population has its own unique attributes and threats to persistence and sustainability.

BROWN TROUT AND RAINBOW TROUT

No effort has been made to quantify the genetic profile of wild Brown or Rainbow Trout populations across West Virginia. Where they exist, populations tend to be stable or thriving. Managers have not expressed much concern for conservation of species genetics. Degraded habitats appear to be the salient limiting factor for wild Brown and Rainbow Trout fisheries, so conservation efforts focus on improving habitat and connectivity to consistent and coldwater sources.

Without any contradictory evidence, it appears wild Brown Trout populations established in the state are a product of our hatchery stock, which has not been augmented since it was established in the 1950s. Broodstock is held over at the Reeds Creek hatchery and spawned annually to produce fingerling and catchable cohorts. The variability in the physical appearance of Brown Trout, either wild or in the hatchery, is the result of original stocks from both mainland Europe and the United Kingdom blended into the resultant broodstock and the subsequent interbreeding of this same family lineage. It is thus unlikely that any wild Brown Trout in West Virginia has any genetic resemblance to any single European progenitor.

West Virginia's Rainbow Trout, like most Rainbow Trout worldwide, originated from California stock of mixed steelhead and Sacramento River populations originally cultured in the 1870s (Behnke 2002). There is no evidence of any pure ancestral strains of Rainbow Trout making their way into East Coast waters, including West Virginia. The Rainbow Trout is the most widespread and cultured trout worldwide (Behnke 2002; Halverson 2010) and little is known about their genetic characteristics outside their native range. In West Virginia's hatcheries, Rainbow Trout broodstock is maintained at the Petersburg hatchery and females are spawned once as two-year old fish, then retained at Reeds Creek to be spawned a second time as three-year old fish. All male broodstock is spawned at age two. All hatchery stock is regulated with daylight and temperature to spawn in the fall, thereby synchronizing growth with stocking needs. Wild Rainbow Trout in West Virginia have been observed to spawn from early fall, through the winter, and into the spring, sometimes with multiple spawning cohorts existing within the same stream (Burke 2008).

Population Surveys

The earliest attempt at population surveys (Table 7, Table 8) within the native Brook Trout range in West Virginia were conducted by William Hay in 1899 at the request of the U.S. Bureau of Fisheries. Those records tell only a partial story of the condition of wild trout (among other) fisheries in West Virginia. By that time, significant reductions of native fishes, including Brook Trout, had been noted, prompting early stockings (as previously described) and the Hay survey (Goldsborough and Clark 1908). In the period between Hay's survey and the publication of the report, the federal fish hatchery in White Sulphur Springs became operational and began supplying trout to repopulate streams in West Virginia. But there was no documented effort to study the effects of these stockings, as there is no known survey information until after the formation of the West Virginia Game and Fish Commission in 1921. By the late 1920s, interest was growing in understanding the impacts from the early logging era and the loss of the last of the virgin forests. Some surveys were carried out to explore the scope of those impacts. From 1928 to 1932 only eight surveys were completed, but they included the first collections of Brown and Rainbow Trout. There is no way to know if these were stream-bred fish or recently stocked, but the locale of some of the observations could indicate the first known occurrences of wild Brown and Rainbow Trout populations in the state.

In 1933, a series of surveys was begun to assess the fishes of the Kanawha River system by a Ph.D. student at Ohio State (Addair 1944). His efforts netted observations of Brook Trout in 12 streams and a single Brown Trout record out of 179 study sites across the entire Kanawha River watershed. Interestingly, there was little interest in his work by the Director of the West Virginia Game and Fish Commission (Kinney 1963b). Another survey effort of note was that of McGavock and Davis (1935) to assess the streams of the Monongahela National Forest for a stream improvement plan and the formulation of a fish stocking policy based on existing conditions. Their initial focus was on the original parts of the National Forest, including the South Branch Potomac River, the North Fork of the South Branch Potomac, major tributaries to Cheat River, headwaters of the Greenbrier River, and the acid streams of Tucker and Randolph counties. A subsequent effort was devoted to the new waters of expanding public acquisitions of the Shavers Fork and the major tributaries of the Gauley River. Those observations of the conditions of the streams and rivers set the stage for generations of stream habitat and fisheries restoration in some of the best native and wild trout waters within West Virginia.

Subsequent survey efforts by many researchers in the state focused less on trout and gamefish and sought to describe the nature of all observed fish communities. However, the expanding efforts of the West Virginia Conservation Commission (WVCC) and its descendants remained primarily on the management of game fisheries, particularly trout. Since 1960, most wild trout surveys have been conducted by the WVCC/WVDNR District and Coldwater Fisheries staff, but significant contributions by others cannot be overlooked:

1976 – 1986: Dr. Jay Stauffer and colleagues for The Fishes of West Virginia book (Stauffer et al. 1995)

1988 – present: Monongahela National Forest Fisheries Biologists and staff,

1989 – present: West Virginia University Cooperative Fish and Wildlife Research Unit,

1998 – present: WVDNR Nongame Aquatic Community Assessment and Restoration Program crews,

2006 – present: WVDEP Watershed Assessment Program.

It is difficult to differentiate the distribution of wild trout populations from that of stocked fisheries based on the available data, as little effort was given to considering the relative value of either from a conservation or angling opportunity viewpoint for many years. Recent survey efforts have been more focused on the quantity and quality of native and wild trout populations and their contribution to providing more diverse angling opportunities. Efforts to catalog the distribution, abundance, and genetic makeup of our native Brook Trout have been at the forefront of recent trout surveys, but interest in wild Brown and Rainbow Trout populations, as well as Brook Trout established outside their known native range, has necessitated more focus on those populations as well.

Table 7.

Occurrence of trout in stream survey records by decade.
Data obtained from the West Virginia Stream Fish Database.

Decade	Number of surveys with trout occurrence
1899-1900	12
1900s	–
1910s	–
1920s	1
1930s	22
1940s	16
1950s	113
1960s	196
1970s	571
1980s	579
1990s	390
2000s	567
2010s	427

Table 8.

Observations of the different trout species in early surveys of West Virginia trout waters.
Data obtained from the West Virginia Stream Fish Database.

Year(s)	Biologist(s)	Brook Trout	Brown Trout	Rainbow Trout
1899–1900	William Hay	X		
1928	Hubbs&Hubbs	X		
1931	A H Wright	X	X	X
1932	Hubbs & Trautman	X		X
1933–1935	John Addair	X	X	X
1935	E C Raney	X		
1935	McGavock & Davis	X	X	X
1946	Schley	X		X
1947–1950	Seaman & Swasey (WVCC)	X		X
1955–1956	Frank Schwartz	X	X	X
1957–1958	Anthony Bodola	X	X	X

Environmental Threats

Native and wild trout are regarded as indicator species of the health of the stream, aquatic ecosystem, and the overall health of the watershed. Indicator species are responsive to changes often before other species of fish respond to such changes. In the case of native and wild trout, there are numerous environmental threats that can reduce their abundance, the maximum size they can attain, or eliminate them from areas they should be found. In some cases, multiple threats add together to reduce or eliminate trout populations. In other more tenuous situations, even a single threat may be great enough to produce similar outcomes.

PHYSICAL HABITAT DEGRADATION

Wild trout require healthy streams with an adequate mixture of riffle, run, and pool habitat. Stream banks should be stable with equal areas of erosion and deposition, usually a result of a forested condition. Large woody material in the stream is also very important. During "The Big Cut" period of the late 1800s and early 1900s most forests surrounding West Virginia's trout streams were clear-cut rapidly without environmental regulations or concerns. Trees on stream banks were not spared and even wood in the streams was removed. Further, the extensive amount of timber slash—undesirable limbs and tops—left to dry on the harvested areas caught fire from the coal-fired railroad engines used to haul the timber out (Clarkson 1964). These fires often burned into the organic layers of soil and left the mountainsides with less ability to hold water. During rain events the water ran off faster, eroding more soil, and destabilizing stream channels. These events left all our trout streams in a condition impaired when compared to prior to The Big Cut.

Improvements in technology, regulations, and land management practices have greatly reduced impacts to trout waters and surrounding lands, but some areas continue to be susceptible to impairments. Poorly implemented timber practices, road design and placement, riparian management, livestock grazing, and removal of wood from streams all contribute to habitat degradation. Properly implemented, these activities can continue to be a part of healthy trout watershed management when carried out with consideration of their impact on the stream and the implementation of best management practices.

SEDIMENTATION

Sedimentation affects trout habitat in general but requires specific discussion because of the sensitivity of wild trout to excessive fine sediment in their environment. To successfully spawn, trout require small, clean gravel in the streambed along with flowing water to keep these substrates flushed clear of sands, silts, and clays. Without adequate spawning areas, wild, stream-spawned trout cannot exist. Fine sediments can either directly reduce available spawning habitat or, if trout spawn successfully, can smother the eggs or hatched larval trout while still in the redd. These fine sediments can fill in the spaces between gravel and cobble, reducing the space that stream insects require to live and thus the amount of food for wild trout. Fewer and smaller fish are often the result.

Sediment can come directly from the streambank or indirectly from outside the area around the stream. Direct sources of sediment include streambank erosion that may be caused by livestock trampling of streambanks or a lack of protective trees and vegetation in riparian areas. Indirect sources of sediment include road systems that deliver sediment from much further upslope via ditches and road surfaces to the stream. This is especially common with unpaved road systems. However, any land use that exposes soil to rain and snowmelt and has a connection to a path of water flow has the potential to add sediment to a wild trout stream. A stream that is at hydrologic equilibrium has the capacity to mobilize and remove excess fine sediments, leaving a channel that has a good assortment of gravel and cobble substrates for spawning habitat and food production.

HABITAT CONNECTIVITY AND FISH MOVEMENT BARRIERS

Wild trout require the ability to freely move upstream and downstream to access suitable spawning areas, preferred feeding areas, cold-water refuge when temperatures become inhospitable, and protective escape cover. This freedom of movement within the watershed, from mainstem rivers to tributaries, allows increased genetic mixing within the population. When wild trout populations become separated from one other, genetic diversity decreases, and in-breeding may occur, which can lead to poor health or local population crash (Whiteley et al. 2013). Dams and poorly designed road or railroad crossings can be barriers to this movement. Barriers may be only partial blockages, restricting passage at certain flow levels or for smaller fish, for example young fish have less capacity to jump. Barriers may also be complete blockages, not allowing fish of any size to pass or preventing passage under all flow levels. Road crossings can be redesigned to allow fish passage, and many such designs have the added advantages of reducing the risk of sedimentation and infrastructure failure during large flood events. Dams are more difficult to configure for complete fish passage but can be modified or designed to allow at least some fish movement, e.g., fish ladders.

Environmental Threats continued

ACID DEPOSITION AND STREAM ACIDIFICATION

High elevation mountains of West Virginia provide the cold water necessary for sustaining wild trout, yet these mountains are also ideal for intercepting air pollution produced in other areas far distant. Pollution from fossil fuel plants and automobiles in the more populated areas of the Ohio Valley and the Midwest travels on a generally west-to-east weather pattern and falls on the mountains of West Virginia as acid rain or snow. Prior to the implementation of the Clean Air Act (1970) and Clean Air Act Amendment (1990), some of the most acidic rain ever recorded was in West Virginia. Many trout stream waters became so acidic that trout were eliminated (Clayton et al. 1998; Petty and Thorne 2005). Acid precipitation has been steadily on the decline since the passage of the Clean Air Act Amendment of 1990. Unfortunately, some of the effects will linger on for decades to centuries longer. Acid precipitation strips the watershed of the soil's natural buffering capacity, which is the ability to neutralize the water prior to entering a stream. In geologies that are naturally more acidic, such as sandstone, and in areas with shallower soils, most of the buffering capacity has been eliminated. Therefore, even though our precipitation today is less acidic, formerly good trout streams located in watersheds that are dominated by sandstone geology frequently retain acidity levels that are too high to support wild trout. In some cases, acidity is elevated but not so much that trout are eliminated. In these instances, trout abundance and average size is typically reduced compared to streams with lower acidity levels.

CLIMATE CHANGE

Local changes due to global climatic shifts are already affecting wild and native trout populations through increased water temperatures, changes to soil moisture, the recharge of groundwater, and extreme stream flow conditions in the form of floods and drought (Isaak et al. 2012; Williams et al. 2015). Stressors caused by climate change are expected to continue to intensify over the next few decades (Jay et al. 2018). Although West Virginia's high elevation trout streams are predicted to be more resilient to the effects of climate change than those in many other areas of the nation (Merriam et al. 2017), our streams and wild trout fisheries will nonetheless be affected. Increasing stream temperatures result in greater physical stress on trout, limit available habitat, increase habitat fragmentation, increase competition with other species, and increase the risk of diseases and parasites. The influence of increased air temperature on water temperature is greatest when a higher percentage of stream flow comes from surface run-off instead of deeper groundwater inputs (Snyder et al. 2015).

Changes in stream flow resulting from variability in precipitation can be direct or indirect. Direct effects include mortality from floods, temperature stress during droughts, and increased risk of predation during droughts. Indirect effects include scoured spawning habitat during floods, increased streambank instability and erosion during floods, and decreased availability of habitat during droughts. These conditions are worsened in areas that already have decreased habitat connectivity, erosion issues, and degraded habitat (Williams et al. 2015). Fall-spawning Brook and Brown Trout are more susceptible to reduced snowpack and increased high flows in the winter and early spring when eggs and larval trout are still in the redd.

Volume and temperature of groundwater are predicted to fluctuate more dramatically because of increasing alteration of larger regional weather patterns due to climate change. Because most West Virginia trout streams rely on surface flow and shallow groundwater, these changes are expected to be harmful to wild trout populations (Snyder et al. 2015). Wild trout populations may be altered dramatically or even eliminated by the timing of environmental cycles of stream insect emergence, spawning conditions, flood peaks, droughts and other interconnected events, many of which are not yet well understood.

Environmental Threats continued

COMPETITION AMONG NATIVE, WILD AND STOCKED TROUT

When living in the same waters, trout compete with others of their own species as well as with other trout species. Brook Trout can be particularly susceptible to competition and predation from nonnative trout. Brown Trout are especially strong competitors with Brook Trout, owing to their similar spawning characteristics, slightly higher growth rates, longer lifespan, larger size, increasing piscivory as they get larger, and the ability to tolerate warmer water than Brook Trout. Within the same habitat, a competitive interaction between a Brook Trout and Brown Trout of the same size will usually be won by the Brown Trout (Trego et al. 2019). If a Brown Trout can hold the best feeding and resting areas, its competitive advantage increases as Brook Trout growth rates become reduced by moving to less than optimal feeding locations.

While the co-occurrence of Brook, Brown, and Rainbow Trout in many streams is often cited as justification that there are few negative effects on any one species, fish population changes due to competition often take a very long time to manifest at levels that can be detected by angling or scientific monitoring. Often, even just one additional stressor (e.g., flood, drought, warm period) may tilt the scales further for the benefit of one species over another much more abruptly. While Rainbow Trout have not displaced wild Brook Trout fisheries in West Virginia as much as they have in the southern Appalachians, there is evidence of this occurring in some streams within the state. Further, an increasingly warm climate will likely shift the competitive advantage between these species. With native Brook Trout as the most cold-water obligate of the three trout in West Virginia, their populations tend to be the most susceptible to added stresses.

Stocking hatchery-reared trout into waters with wild trout populations can affect the wild population in several ways. While the mixing of stocked and wild Brook Trout may result in genetic alteration in some waters, this has not been observed to be a widespread problem in West Virginia (Kazyak et al. 2018; Morgan et al. 2021). Stocked trout are more likely to affect wild trout by displacement from habitats and direct competition for resources (Weber and Fausch 2003). Also, supplementary stocking of waters harboring wild trout is not shown to increase the overall harvest in the long-term, as the stocked fish often just displace the wild fish without a change in the overall capacity of the stream to hold more trout (Vincent 1972; Lyach 2020).

Research

The work collecting, rearing, and repatriating native Brook Trout stocks is some of the more unique research into wild trout going on in West Virginia. Each fish collected for either field-spawning or hatchery stock has been assessed for its genetic lineage; and each fish released is also fin-clipped for genetic assessment and as a mark indicating a direct result of the hatchery-rearing. Streams receiving planted fish are stocked only with those fish of genetic makeup most appropriate to its watershed; fish are not transplanted across significant drainage divides where there is not genetic similarity.

Other genetic research is ongoing to assess the populations in the watersheds of the Ohio basin. Much work has been done within the Chesapeake Bay drainages and the very southern part of the Brook Trout range, but very little attention has been paid to the West Virginia Brook Trout populations of the Ohio River drainages of the state. The Greenbrier, Gauley, Elk, Tygart, and Cheat River watersheds all originate closely to one another, but end up at an ultimate destination by very different means. The story of the origin of these varied Brook Trout populations and their place in the region-wide genetic assessment could be deciphered by establishing the amount of similarity or difference among the watersheds.

Cooperative research with West Virginia University continues to focus on long term trends of native Brook Trout populations. Based on analysis of data, local effects from regional and global climate patterns have been identified. Continued work with M.S. and Ph.D. level students and their professors will give agency biologists information needed to develop new strategies for making informed management decisions to benefit wild trout fisheries and the anglers who seek these opportunities.

Recently completed work with West Liberty University focused on the predation of Rainbow and Brown Trout on crayfishes to determine if there is any detrimental effect on two species listed in accordance with the Endangered Species Act: the endangered Guyandotte Crayfish *(Cambarus veteranus)* and the threatened Big Sandy Crayfish *(Cambarus callainus)*. Indications are that Brown Trout are effective at utilizing the Coal Fields Crayfish *(Cambarus theepiensis)*, which has similar life history characteristics to the Guyandotte Crayfish, as a preferred food item.

As such, Brown Trout should not be stocked in waters where the Guyandotte Crayfish exists, may exist, or may be restored in the future. This finding is especially impactful to the fingerling stocking program and any efforts to broaden opportunities for increasing wild Brown Trout populations in the southern coalfield counties. Introducing Rainbow Trout instead of Brown Trout could decrease the risk of predation on native *Cambarus* species given the Rainbow Trout's lack of consistency in targeting

Research continued

crayfish as a food item. Monitoring potential predation impacts to Federally listed crayfish populations is prudent when Rainbow Trout are stocked in waters harboring such crayfish populations. In streams where this research was conducted, Coal Field Crayfish occur in less relative abundance to the Spiny Stream Crayfish *(Faxonius cristavarius)* than the Guyandotte Crayfish where they co-occur with the Spiny Stream Crayfish. Rainbow Trout predation on crayfish was reported to be slight, increasing as juvenile Spiny Stream Crayfish molt in mid- to late-summer. While the Guyandotte River Crayfish may also be vulnerable during that time period, the tendency for Rainbow Trout to seasonally key on more common food items (Laudon et al. 2005) makes it more likely to select the Spiny Stream Crayfish rather than the Guyandotte Crayfish. Because there is evidence that the Spiny Stream Crayfish can be a direct competitor to the Guyandotte Crayfish, perhaps introducing Rainbow Trout into waters where they exist could help regulate populations of Spiny Stream Crayfish to the benefit of the Guyandotte Crayfish. Any management actions in streams harboring the Guyandotte Crayfish must be proposed to and approved by the U.S. Fish and Wildlife Service and adhere to standards outlined in the Endangered Species Act.

Management

Increasing wild trout populations has been a goal of the West Virginia Division of Natural Resources and its predecessors since the decline of native fisheries was observed by the late 1800s. Early fisheries scientists apparently didn't realize the stringent requirements of trout, and especially the native Brook Trout, necessary for improving and establishing reproducing, self-sustaining populations. Many efforts to reintroduce native species and exotic surrogates were undertaken, with mostly very poor results. Restocking of waters to provide short-term fisheries became the norm, with biologists quickly recognizing the limitations created by the impacts of a developing populace and industrial base and the incessant need for natural resources for a growing nation.

The importation of Brown and Rainbow Trout, at the time regarded to be hardier compared to their native counterparts, provided opportunity for resource managers to increase fish available for anglers and to attempt the establishment of populations of additional species that were not readily available to most anglers of the time. Brown Trout are more tolerant of fine sediments and somewhat warmer temperatures and are a top predator where they exist. This made them a useful alternative for managers to introduce into new waters where the landscape had been altered, becoming inhospitable for the native Brook Trout. Rainbow Trout are readily cultured in a hatchery setting, so they have become widespread (Halverson 2010) as another useful management option. There are instances where the native trout were intentionally eliminated in a stream and replaced with cultured stocks with the hope of providing a fishery superior to the natives. There are no remaining examples where this was successful. Even though they may not have understood the mechanisms limiting their success, fisheries managers have always regarded the establishment of self-sustaining wild fisheries as superior to raising and stocking hatchery-produced fish regularly. The reasons are many: it is more cost-effective, there is less infrastructure construction and maintenance, and wild fish are generally healthier than those crowded in the hatcheries. These arguments for restoring native and establishing wild fisheries are as important today as they have ever been.

The success of self-sustaining fisheries is a bellwether for general environmental condition. The presence of holdover trout in a stream, and particularly a reproducing population, imparts more stringent regulatory protections of water quality by the West Virginia Department of Environmental Protection. It also affects the time that in-stream projects can take place, as the WVDNR's Environmental Coordination staff implement state and Federal restrictions on certain activities, such as culvert and bridge work, during the period when wild trout would be spawning until their eggs hatch from September 15 – March 31. With some exceptions, wild trout typically live in areas that are relatively pristine, so living along a trout stream or just

Management continued

downstream is attractive to many people because the water is considered to be of high quality and the landscape is largely natural in appearance.

Today's West Virginia Division of Natural Resources strives to maintain the protection and sustainability of wild trout streams. A changing climate adds difficulties where habitats are already bordering on being too warm for trout; and finding new waters that will sustain trout populations is becoming exceedingly rare. Maintaining existing stream mileage is a high priority, but new development, whether residential, industrial, or road infrastructure, is continually creeping into areas where sustaining coldwater fisheries is becoming more difficult. Many recently established (or at least recognized) wild trout fisheries in West Virginia are the result of anglers moving harvested fish into productive but previously trout-free waters fed by cold and clean mine discharges rather than targeted agency-directed management. Regardless, some quality wild trout resources have been created in an area historically devoid of a native trout fishery and in much need of a stimulating outdoor recreation economic boost. Alternatively, several projects are underway to restore native Brook Trout into spring-fed streams of counties in the Eastern Panhandle that have had their populations eliminated for various reasons over the last century or more.

The use of hatchery-raised fingerling Brown and Rainbow Trout for planting into streams supporting their survival and growth (but not necessarily sustainable reproduction) has ebbed and flowed throughout the years but continues to provide an opportunity for semi-wild fisheries at a much lower cost to the state hatchery system. The use of volunteers, mostly members of Trout Unlimited and local watershed groups, has made the program an effective means of increasing the footprint of wild trout fisheries where the WVDNR could not manage on its own. A recent partnership with West Virginia University's Reymann Memorial Farm in Wardensville has opened a new wild trout restoration opportunity. The WVDNR has been provided use of an unutilized aquaculture facility to hatch and raise wild native Brook Trout stocks from multiple watersheds for augmenting reduced populations, restoring extirpated fisheries, and supplementing the genetics of severely depressed populations. The program suffers from annual variability in the collection and spawning of wild fish, but it has so far showed great promise in the four primary streams that have been planted with the wild-source fish. Of course, monitoring of this success is ongoing and changes will be made as necessary to improve future outcomes.

Habitat Improvement

Improving habitat for native and wild trout is one of the most effective ways management agencies can increase and improve trout fishing opportunities in West Virginia. Wild trout populations are usually limited in their carrying capacity by the amount of available high-quality habitat and competition for available resources. A population such as this is considered "density dependent" and can only support a certain quantity of fish of a certain size. As the quantity of trout decreases, the average size will increase and as the quantity increases, the average size will decrease (Lobon-Cervia 2007; Utz and Hartman 2009). Restoring and improving habitat is the foundation for meeting the objectives of increasing both the abundance and size of fish.

Habitat improvements can take the form of direct manipulation of in-stream habitat or actions that indirectly improve the conditions and function of the watershed, and ultimately the habitat for trout. Examples of actions that indirectly improve habitat include improvement of land uses which reduce erosion such as no-till farming, road maintenance or obliteration, maintaining riparian buffers, best management practices for forestry and grazing, and any other actions which protect soil and water quality at a watershed scale. However, when managers discuss stream habitat improvement, the term is usually used to refer to directly manipulating the shape and function of the stream channel, stream banks, aquatic connectivity, and the amount of cover, shading, substrate composition, and other elements of the stream environment that may affect trout waters. The study and use of fluvial geomorphology methodology has become an accepted practice for stream mitigation and restoration.

Soon after the "big cut" of the early 20th century, anglers and land managers realized the impact on West Virginia trout fisheries was the result of widespread degradation of the land and aquatic habitats (McGavock and Davis 1935). The Civilian Conservation Corps (CCC) planted millions of trees in the range of trout in West Virginia from 1933–1942. They also began the first extensive attempt at stream habitat improvements, with restoration projects using logs and rocks to recreate pools, protect streambanks, and provide some variation in streams that had largely been simplified by the past land activities. Of the 67 CCC camps in the state, 31 were in or near the newly formed Monongahela National Forest (MNF). Fortunately for the state's trout, approximately 90% of the trout streams in the state are within the MNF. The impact this work had on conserving the remnant trout populations cannot be overstated. In fact, some of their habitat improvement structures remain intact today.

Since this early restoration effort, additional agencies, non-governmental organizations (NGOs), and private landowners have demonstrated an increased focus on habitat improvements. They include the WVDNR, WVDEP, WVDOT, USFS, West Virginia University, Trout Unlimited, U.S. Fish and

Habitat Improvement continued

Wildlife Service, U.S.D.A. Natural Resources Conservation Service, WV Conservation Districts, WV Conservation Agency, and many others.

The WVDNR has been actively working to restore waters impaired by acid precipitation for more than 60 years. Currently more than 60 streams are treated with crushed limestone sand, directly improving conditions in 300+ miles of headwater streams for native Brook Trout and other wild trout. During the past decade, the WVDNR has also significantly increased its emphasis on physical habitat improvement through a series of partnerships focused on instream and riparian habitat restoration and enhancement in trout streams (Table 9).

As the land management agency for the MNF, the USFS continues to make habitat restoration and improvement a top priority both through staffing and contracting, but especially through partnerships with the agencies and organizations mentioned above. Key trout habitat accomplishments of the USFS and its partners during the past decade are detailed in Table 10.

In-stream habitat improvements consist of adding large woody material (LWM) and/or rock structures to mimic naturally occurring features that protect stream banks, scour pools, sort spawning gravels, provide escape cover, and reconnect streams to their floodplains. In Appalachia, trees provide an abundant source of LWM in streams and were historically a dominant factor of stream stability and trout habitat. Although our state has reforested considerably in the past 100 years, the average age of trees is still much younger than the average life span of most of the tree species. Therefore, it will be many decades before nature is adding LWM at the same rate that occurred historically. Furthermore, stream channel incision from the past remains an issue, and LWM that does fall in the stream today often spans the stream across high banks or is battered and shifted constantly by altered high-flow patterns, neither of which offers much useful habitat to aquatic organisms. Habitat improvements can accelerate stable LWM additions, correct channel incision, and provide immediate improvements for wild trout.

Stream structures, both LWM and rock, can be constructed to appear as natural trout habitat and land managers have a diverse toolkit of different types of stream structures which can be used to improve conditions for trout. Log and rock vanes, LWM jams, wing deflectors, sills, J-hooks, cross vanes, complex lateral LWM jams, and step pools are just some of the structure types commonly used (Rosgen 2006; PA Fish and Boat Commission 2007). Each project location requires careful consideration of the unique characteristics of the stream at that spot, including the hydrology and hydraulics of the stream, the size and amount of bedload movement (rocks in the stream that move during floods), surrounding infrastructure and property, and the objectives of the restoration activity. In general, habitat improvements that recreate natural processes are most likely to succeed in the long term (Roni et al. 2002; Wohl et al. 2005).

Although most of habitat improvements described here have occurred in upstream and headwater reaches of streams that hold native and wild trout, the benefits of this work extend far downstream to stocked trout waters, to warmwater streams, and even to reservoirs. Acid that is neutralized in headwater streams for Brook Trout or other wild trout no longer degrades downstream waters, benefitting stocked trout, warmwater fish, anglers of all types, and aquatic life in general. A similar array of benefits derives from other upstream habitat improvements. Fine sediments that are eliminated from headwater streams no longer add to sediment loads in downstream waters; headwater streams that are re-cooled by riparian plantings no longer contribute the same thermal loading to downstream stocked trout streams. The bottom line on habitat improvement in trout streams is that the benefits accrue to all anglers, both warm- and cold-water sport fish, and a broad array of other aquatic life.

Partnerships

Partnerships form the foundation of effective and efficient management of wild trout resources. Numerous formal and informal partnerships exist between state and federal agencies, non-governmental organizations, universities, and citizen groups. For example, the WVDNR, USFS, WVDEP, Trout Unlimited, and West Virginia University all monitor, research, and collect information on trout populations in West Virginia. These efforts capitalize on coordinating efforts to maximize efficiency and increase the capacity of each agency or group. Partnerships are also critical for effective habitat management at a large enough scale to provide measurable results for wild trout populations. Large corporate landowners have become important partners as well, since they control access to many high-quality wild trout stream watersheds. In-stream habitat improvement, dumping limestone sand, and gaining angler access in dozens of miles of wild trout water could not happen without these public-private agreements. Partnerships take many forms, including on-the-ground collaboration, funding support, the use of shared equipment and resources, and data sharing.

Table 9.

WVDNR-led stream habitat improvements implemented since 2010.

Stream and Activity	Date	Miles Improved	Partners/Contractors
Shavers Fork – Beaver Creek RR Culvert Passage Restoration	2011	6 miles combined for tributary and Shavers Fork mainstem	WVU, EBTJV, NOAA, NRCS, Trakspec Corp., WV State Rail Authority, CVI, Congressman Alan Mollohan
Shavers Fork – Mainstem Habitat Restoration	2011-2012	4 miles of Shavers Fork mainstem	WVU, NRCS, TVCD, USFS, North State Environmental
Shavers Fork – Oats Run RR Culvert Passage Restoration	2012	5 miles combined for tributary and Shavers Fork mainstem	WVU, EBTJV, NOAA, Trakspec Corp, WV State Rail Authority, Snap-Tite Culvert, Cass State Park, CVI, Congressman Alan Mollohan
Shavers Fork – Lamothe Run RR Culvert Passage Restoration	2013	5 miles combined for tributary and Shavers Fork mainstem	WVU, EBTJV, WVDEP, NOAA, Trakspec Corp, WV State Rail Authority, Snap-Tite Culvert, Cass State Park, CVI, Mr. Steve Callen, Congressman Alan Mollohan
Kumbrabow State Forest – Mill Creek Instream Habitat Enhancement	2014-2016	3.5 miles of Mill Creek mainstem	WVU, EBTJV, WVDOF, WVDNR-Parks
Shavers Fork – Spruce Riparian Habitat Restoration	2017-2019	1 mile of Shavers Fork mainstem	WVU, EBTJV, WV State Rail Authority, Durbin Greenbrier Valley RR, YouthBuild North Central WV, Snowshoe
Holly River State Park – Laurel Fork of Holly River Instream Habitat Enhancement	2018-2019	1.5 miles of Laurel Fork mainstem	WVU, Holly River State Park
Spring Run WMA – Spring Run Instream Habitat Enhancement	2019	0.75 miles of Spring Run mainstem	WVU
Cass State Park – Leatherbark Run Instream Habitat Enhancement	2019	0.1 miles of Leatherbark Run mainstem	Cass Scenic Railroad State Park
Clover Run of Cheat – Instream Habitat Enhancement	2019-2020	1 mile of Clover Run mainstem	WVU, Patriots 4, Major General Randy West, Mr. Chuck Stalnaker

Promotions

There are no current promotions in West Virginia specifically for native and wild trout anglers. The only award system in place is the Trophy Fish Citation program, rewarding anglers for catching certain fish over a designated length. Legally harvested wild Brown or Rainbow Trout 21 inches or larger qualify for a certificate. The length for Brook Trout is 15 inches and catching a native Brook Trout of this size is a genuine challenge. A review of the Trophy Fish Citations awarded for Brook Trout in recent years indicates that all were hatchery-reared and likely stocked shortly before harvest. It is also unlikely that many Rainbow Trout citations are for wild fish. Because Brown Trout survive longer in many more waters, it is difficult to determine whether the Trophy Fish Citations are for wild or recently stocked Brown Trout.

Table 10.

USFS-led stream habitat improvement projects implemented since 2010.

Restoration Activity	Location	Quantity	Year	Partners
Stream Habitat Enhancement with Large Wood	East Fork Greenbrier at Island Campground	1 mile	2013	Trout Unlimited
	Seneca Creek	0.25 mile	2015	Trout Unlimited
	Upper Greenbrier Watershed (East Fork and tributaries, Little River East Fork, Little River West Fork, and West Fork tributaries	66 miles	2015-2017	Trout Unlimited
	Upper North Fork South Branch Watershed (Big Run and tributaries, Vance Run and tributaries)	34 miles	2018-2021	Trout Unlimited
Fish and Aquatic Organism Passage Restoration	Upper Greenbrier Watershed (East and West Forks and tributaries)	26 structures	2010-2020	Trout Unlimited, Canaan Valley Institute
	Black Mountain Run (Williams River Watershed)	1 bridge	2018	
	North Fork Deer Creek	1 bridge	2019	
	Clover Run Watershed (Indian Run, Hobson Run, Right Fork Clover)	3 bridges	2020	WVDOH
	Cranberry and Cherry River tributaries	7 structures	2020-2021	USDOT Federal Highway Administration
	Upper North Fork South Branch Watershed (Back Run of Sawmill and Vance Run)	3 barriers removed or replaced	2021	Trout Unlimited
	Elklick Run of the Black Fork	1 bridge	2021	WVDOH
Grazing Allotment Improvements (Riparian cattle exclosures)	Upper Greenbrier and Upper Dry Fork Watersheds	2750 acres	2014-2015	Trout Unlimited
Streambank stabilization using natural channel design	Little River of East Fork	100 feet	2017	WVDOH
	Knapps Creek	200 feet	2018	WVDOH
	Left Fork Clover Run	200 feet	2021	WVDOH
Road and Trail Decommissioning and Soil Restoration	Upper Williams Watershed	16 miles	2010-2019	Canaan Valley Institute, Trout Unlimited
	Throughout Upper Greenbrier Watershed (East and West Forks)	84 miles	2013-2017	Canaan Valley Institute, Trout Unlimited
	Throughout Upper North Fork South Branch Watershed (Big Run and Laurel Fork)	20 miles	2018-2021	Trout Unlimited
	Shavers Run (Middle Tygart Watershed)	1 mile	2020	Canaan Valley Institute
	West Fork Glady	12 miles	2020	Canaan Valley Institute
Riparian Reforestation	Upper Greenbrier Watershed (East and West Forks and tributaries)	33 miles	2014-2017	Trout Unlimited, AFNHA AmeriCorps
	Upper North Fork South Branch Watershed (headwaters of Big Run)	2 miles	2018-2021	The Nature Conservancy, Trout Unlimited
	Upper Williams River and Little Laurel Run	1 mile	2018	Trout Unlimited, AFNHA AmeriCorps
	Gandy Creek headwaters	2 miles	2021	The Nature Conservancy, Trout Unlimited
	Dry Fork headwaters	1 mile	2021	The Nature Conservancy, Trout Unlimited
	North Fork South Branch Potomac	0.5 miles	2021	AFNHA AmeriCorps
Mineland Restoration	Mower Tract - Shavers Fork headwaters	990 acres	2012-2021	WVDNR, Greenforests Work, WV Highlands Conservancy, The Nature Conservancy, University of Kentucky

See Table 11 on Page 70 for the ranking of all objectives.

Funding, Investment and Capacity

ISSUES

The ability to manage West Virginia's trout fishery is a function of funding, investment and capacity. In the context of this plan, Funding means the amount of money available for trout management. Investment means the decisions that we make about the programs and activities to which we direct funding. Capacity means our ability to translate funding and investment decisions into desired outcomes.

Trout anglers are concerned about each of these three components. Current funding constrains both our investment decisions and our capacity to manage trout fisheries in the state. This is true for the management of both stocked and wild trout. For stocked trout anglers, the current level of available funding is not sufficient to modernize and optimally staff the state's outdated hatcheries, a step that will be necessary to significantly expand and enhance stocked trout management. Wild trout anglers want to see substantial investment directed to the management of wild trout and their habitat as a major part of the overall management mix in the state. Trout anglers support additional investment in efforts to achieve better compliance from anglers, other publics, and industry with laws and regulations designed to protect the fishery resource. Adequate public awareness of the economic, environmental, and recreational value of the state's coldwater resources will be a critical component for success in addressing each of the components of this broad issue.

VALUES

The abundant coldwater resources of West Virginia contribute to a strong trout fishing and conservation heritage. Stakeholders want to see these resources promoted and utilized more. Enhancing these resources improves residents' quality of life and strengthens the statewide and local economies. Increased participation in fishing and conservation efforts creates additional funding to pursue those recreation and conservation issues. Increased funding comes from not only license fees but also the direct expenditures by anglers in local communities. The public would like to see management broadened to include diverse partnerships including landowners, government organizations, and non-profit organizations. Sustainable funding is necessary to enhance the conservation of quality coldwater fishing opportunities to maintain and strengthen the outdoor heritage for future generations of residents.

GOALS

Ensure adequate funding is available, through a variety of mechanisms, to allow for investment in programs and activities that increase recreational opportunities. Increase capacity of streams to support and sustain trout habitat and angler opportunity over a larger and more diverse area. Additionally, increase the ability of WVDNR and its partners to adequately maintain healthy trout populations in those areas.

OBJECTIVES AND STRATEGIES

1. Conduct a financial evaluation of current WVDNR trout management activities by December 31, 2022.
   - a. Evaluate trends of current license sales in cooperation with the WV R3 (Recruitment-Retention-Reactivation) program license sales objectives.
   - b. Estimate annual cost of the trout stocking program and project future costs of the trout stocking program.
   - c. Identify current and projected hatchery operations and renovations costs.
   - d. Establish a prioritized list of hatchery renovation projects with projected costs.
   - e. Estimate current cost of native/wild trout management efforts.
   - f. Estimate costs of currently proposed trout habitat improvement projects.
2. Identify additional funding sources for programs and activities that will enhance recreational trout fishing opportunities by July 1, 2023.
   - a. Create additional voluntary licenses (stamps) and/or donation options for anglers willing to contribute financially to trout management programs and activities (habitat, hatchery program, restoration, conservation easements).
   - b. Assess public support for increased trout stamp fees to offset costs in the trout management program.
   - c. Assess public support for a user-pay fee for designated fishing and boating access sites. (e.g., license required to launch and park at a DNR-managed access site; however, a free sticker/license provided to fishing license buyers).
   - d. Consider an annual fee for any business utilizing public fishing and boating sites for clients.

Funding, Investment and Capacity continued

3. Develop 25 partnerships with private landowners, local entities, municipalities, industries, conservation partners, and public groups that support long-term investments in stocked trout management or help sustain wild/native trout management by July 1, 2026.
   a. Identify groups that are interested in developing programs that improve trout fishing and support trout management activities.
   b. Create an "Adopt an Access/Watershed" program for maintenance and cleanup of streams, fishing areas, and boating access sites.
   c. Obtain funding and volunteer labor from private groups and non-governmental organizations (NGOs) to support trout management.
4. Identify expenses required to enhance stocked and wild/native trout programs by December 31, 2023.
   a. Develop a prioritized list and associated expenditures for capital improvements at coldwater hatcheries.
   b. Develop a prioritized list and associated expenditures for native/wild trout restoration activities.
   c. Develop a prioritized list and associated expenditures for trout habitat improvements activities.
   d. Identify native/wild trout streams and/or watersheds that would benefit from purchase or enrollment in a conservation easement.
5. Develop a financial plan and balance sheet that projects operational costs to support the trout management program by December 31, 2023.
   a. Create a plan that defines future staffing requirements for management of stocked and wild trout, stream habitat restoration, and law enforcement.
   b. Create a plan that defines the goods, services, equipment, and motor vehicles required for management of stocked and wild trout, as well as stream habitat restoration.

Diversifying and Enhancing Public Fishing Access

ISSUES

Although West Virginia has an abundance of access areas for fishing, the need for additional public access is a recurring issue. However, acquiring new access is limited because of the financial constraints incurred by the purchase and maintenance of additional areas.

Diverse stakeholder interests create the need for both public and private access in streams, rivers, lakes, and reservoirs. Private fishing access, particularly on stocked trout waters, is often lost due to increased litter, crowding, trespassing, and other factors. Loss of access not only reduces fishing opportunities but creates fisheries that are more difficult to access. Therefore, maintaining and increasing fishing access on private lands requires understanding landowner concerns and developing strategies to address them. Litter and damage to river, lake, and reservoir access areas is also an issue on public lands.

Diversifying and enhancing access to fishing resources is not just dependent on acquiring new areas. Improving facilities, shoreline access, and access for disabled anglers would allow access to meet the diverse needs of anglers. However, construction and maintenance of fishing access requires outreach on the value of access, dedicated funding, and strategic partnerships. Construction of complex fishing access facilities is also dependent on the quality of the site.

Anglers are required to fully understand which streams are open to public access and which adjacent lands can be utilized for access. Outreach is critical for informing users of land rights and regulations that are uniformly enforced across jurisdictions within the state.

VALUES

The availability of public fishing access provides value to trout anglers in West Virginia in many ways. All fishing opportunities are made possible through the access to public waters, whether it be through public or private land. However, accesses are not only important in that they provide the land and facilities for fishing, but they also afford the public enhanced aesthetics and scenery. Additionally, enhanced access provides a sense of assurance that anglers are in legal good standing when fishing at a particular location. Finally, enhanced access offers anglers across the state and from a variety of demographics and with diverse fishing preferences a sense of ownership in the resource.

Diversifying and Enhancing Public Fishing Access continued

GOALS

Increase, improve, and protect public access to coldwater fisheries across the state. Provide public education on access opportunities and available facilities.

OBJECTIVES AND STRATEGIES

1. Increase the number of trout stocking access points by 10% percent (200 additional locations) by January 1, 2026. The WVDNR currently stocks trout at approximately 2,000 different access points across the state.
    a. Identify additional stocking locations that also provide angler access points within the current stocking reaches on stocked streams and lakes.
    b. Identify additional waters for trout stocking in large streams not currently stocked with trout to create more acres of stocked trout water.
    c. Provide additional signage and mapping as needed to identify access points available to anglers.
    d. Conduct creel surveys at a minimum of every five years to evaluate angler satisfaction.
2. Improve the quality of current public access points by providing facilities for families, youth anglers, and disabled anglers beginning in 2023.
    a. Identify trout stocking access points suitable for improvements.
    b. Acquire funding for facility improvements and secure financial resources to provide adequate maintenance.
    c. Provide educational materials regarding the availability and location of public fishing access points and facilities.
    d. Conduct creel surveys to estimate use and angler satisfaction at a minimum of every five years.
3. Create partnerships with public and private entities to expand angling access and improve facilities for coldwater resources starting December 31, 2022.
    a. Enhance communication and working relationship with the USFS to improve public stocking access and upgrades of current facilities.
    b. Establish and maintain a working relationship with other state agencies and local governments to promote angling access and facility improvements.
    c. Improve intra-agency coordination to identify and promote additional angling opportunities and family friendly experiences on current WVDNR properties.
    d. Conduct creel surveys at a minimum of every five years to evaluate angler use access and satisfaction.
4. Provide access to documents that describe the legal rights for stream access on private land by January 1, 2023.
    a. Use information from WVDNR's law enforcement division and legal counsel to clarify the agency position of stream access and fishing streams on private land.
    b. Educate and improve angler and landowner awareness of private land rights and encourage anglers to never cross or park on posted property without landowner permission.
    c. Provide the public with current legal documents on stream ownership and publish WVDNR position in the fishing regulations and website.
    d. Provide anglers with information for reporting and acquiring law enforcement assistance for inappropriately posted streams or landowners intentionally interfering with angling activities.

Habitat

ISSUES

Healthy populations of trout require connected stream networks that feature a continuous supply of cold, clean water, and a diverse blend of habitats including deep pools and swift flowing riffles with abundant cover. Trout populations can become compromised and potentially eliminated where habitat conditions are impaired.

There is a need for more adequate protection and restoration of coldwater habitats, including the streamside riparian buffers, overall water quality, and better watershed connectivity. Improved public awareness and education regarding the importance of healthy coldwater habitat is essential. Coldwater habitat restoration projects should be prioritized and evaluated to determine if current regulations provide adequate habitat protection. Partnerships with local communities and awareness of stream habitat restoration may also promote tourism.

VALUES

West Virginia's coldwater streams are a unique resource that are valued by stakeholders, not only for the trout fisheries they support, but also for other features associated with quality trout fisheries. The public sees this as a unique resource that they want to conserve and hand down to future generations. Given degradation to the habitat that has occurred historically due to poor land practices, the public is interested in recovering cold water habitats throughout the state. Stakeholders would like to see coldwater fishery habitats recovered to enhance recreational fishing opportunities while also creating other benefits such as improved aesthetics, outdoor recreation opportunities, and stronger local economies. The public understands that restoring coldwater habitats improves the resiliency of the ecosystem and the trout fishery. Finally, stakeholders believe that there is a link between the health and condition of the resource and the amount of people that use and value it such that environmental stewardship will be enhanced as coldwater stream habitats are restored.

GOALS

Maintain or enhance existing high-quality trout habitats and restore those areas that have been degraded. Promote appropriate land use practices to protect water quality and quantity. Engage traditional and non-traditional partners in stream habitat management opportunities.

OBJECTIVES AND STRATEGIES

1. Protect 25 at risk stream segments with existing high-quality trout habitat by December 31, 2026.
    a. Identify and prioritize watersheds with existing trout populations or coldwater resources lacking current protection from degradation.
    b. Collaborate with partners, state and federal agencies, landowners, and the public to protect and restore trout habitat by using currently available methods and techniques under existing programs.
    c. Provide financial assistance and/or agency approval for land acquisition by public or private entities or conservation easements in wild trout and coldwater watersheds.
2. Enhance or restore 30 miles of in-stream physical habitat by December 31, 2026.
    a. Identify and prioritize in-stream physical habitat enhancements or restoration of trout streams with impaired habitat conditions.
    b. Collaborate and provide financial and/or agency position support to partners, state and federal agencies, landowners, and the public to enhance or restore trout habitat.
    c. Incorporate restoration or enhancement of aquatic habitat into forest management and land-use planning.
    d. Develop partnerships and agreements with agencies and organizations to maximize existing programs and leverage funding opportunities.
    e. Improve habitat at existing trout fishing access areas.

Habitat continued

3. Maintain 300 miles and improve an additional 50 miles of water quality to support trout populations in streams by December 31, 2026.
   a. Continue existing limestone treatment programs and expand where feasible.
   b. Identify and prioritize opportunities to mitigate coldwater acidity issues where trout populations have been extirpated or reduced.
   c. Identify, prioritize, and implement riparian restoration in trout streams.
   d. Review current literature and conduct additional studies to better understand how other factors (e.g., sediment, nutrients, rural sprawl, etc.) affect water quality in trout streams and provide recommendations to mitigate those effects.
   e. Provide financial and/or agency position support for programs directed at water quality maintenance and improvements and the establishment of best management practices (BMPs).
   f. Collaborate with partners (e.g., WVDOF, USFS, WVCA, USFWS, NRCS, TU, WVDOH, Chesapeake Wild, etc.) to implement projects on public and private land to improve water quality and quantity.
   g. Develop and engage with traditional and non-traditional partners to support and enhance land use practices that improve conditions in coldwater habitats.
4. Increase connectivity by restoring fish passage at 25 locations by December 31, 2026.
   a. Prioritize, compile, and assess existing data on fish passage barriers on wild and native trout streams (e.g., NAACC).
   b. Collaborate with partners (e.g., USFS, USFWS, TU, etc.) to connect high-quality trout stream habitats.
   c. Provide financial and/or agency position support for programs and BMPs that maximize passage of aquatic organisms for new projects.

Ecological Health and Risks

ISSUES

Landscape disturbances have resulted in a loss of high-quality trout habitat. Larger-scale watershed restoration efforts have additional ecosystem benefits, including nutrient cycling, controlling erosion and sediment control, and reducing the impacts of climate change and other natural disasters. Inadequate resources and efforts under the current trout management system are being prioritized to watershed-based ecological restoration.

Fish stocking can result in additional competition between trout species and other organisms. Increases in species competition can also occur between wild and stocked trout populations. Trout management regulations to separate stocked from wild trout populations are not adequate to manage fish populations especially at the watershed scale.

Fish stocking, anglers moving fish to alternate locations, and the risk of disease transfer could cause fish health concern thought the ecosystem. Information is lacking to evaluate and monitor potential disease risk in hatchery-reared and wild fish populations, and disease concerns should be taken into consideration to insure healthy fish populations.

VALUES

Overall ecological health is valuable to the aquatic ecosystem. Healthy native, wild, and stocked fish populations are needed to create sustainable fisheries resources. A sustainable and healthy fishery can mean more fish of larger size attracting users and increasing overall economic value. The conservation of threatened and endangered species and preservation of genetic integrity are also ecological considerations that preserve the rich heritage of aquatic resources throughout West Virginia. Aquatic ecosystem health is dependent on clean water resources, which makes everyone a stakeholder with a shared responsibility to pass our valued aquatic resources to the next generation.

GOALS

Better understand the variety of ecological threats to trout populations. Educate the public on the threats to increase awareness and stewardship. Improve management and conservation of trout to create sustainable fisheries and minimize adverse impacts to the aquatic ecosystem.

Ecological Health and Risks continued

OBJECTIVES AND STRATEGIES

1. Establish monitoring programs on ecological threats that affect water quality, habitat, and climate change across West Virginia by December 31, 2023.
   a. Review existing sources of data and information and identify gaps and recommend monitoring locations.
   b. Collect trout population and ecological data for all watersheds (HUC-8).
   c. Increase continuous temperature monitoring in potential wild and native trout streams by 10% across the state.
   d. Increase pH monitoring in potential wild and native trout streams by 10% across the state.
   e. Collaborate with DEP to review and prioritize sites for monitoring aquatic insects.
   f. Collect habitat suitability data in native trout streams.
   g. Continue to identify aquatic connectivity issues in trout waters.
   h. Fund research to improve our knowledge and understanding of ecological threats across the state.
   i. Identify partnerships and opportunities for collaboration to expand monitoring programs.
2. Implement fish health monitoring programs for hatchery and wild trout by December 31, 2023.
   a. Conduct annual fish health testing at hatchery facilities.
   b. Develop a protocol that prohibits stocking trout with known or potential fish health issues.
   c. Monitor fish health in priority native trout streams annually.
   d. Establish biosecurity protocols in hatchery facilities.
   e. Utilize regional fish health risked based assessment tools when evaluating stocking strategies.
   f. Fund research to improve our knowledge and understanding of fish health.
3. Develop a program to monitor the genetic integrity of wild and stocked populations by December 31, 2023.
   a. Develop a protocol to conduct genetic evaluations annually.
   b. Conduct genetic evaluation in priority streams annually.
   c. Produce triploid trout to preserve the genetic integrity in certain stocked waters.
4. Establish a public outreach program on the ecological risks to trout populations (e.g., moving fish, water quality, habitat impairment, exotic species, etc.) by December 31, 2022.
   a. Create signs to post at trout streams and lakes that describe the ecological threats to trout populations.
   b. Publish videos on YouTube channels annually that describe the ecological threats to trout populations.
   c. Publish social media posts annually that describe the ecological threats to trout populations.
   d. Conduct programs in schools that educate students on the ecological threats to trout populations.
   e. Incorporate educational material that describes the ecological threats to trout populations into Trout in the Classroom Program.
   f. Work with WVU to develop 4H curriculum / project books that describe the ecological threats to trout populations.
5. Develop a database to store, analyze, and share trout data by December 31, 2024.
   a. Develop an enterprise or cloud-based system to facilitate collaboration.
   b. Collaborate with Eastern Brook Trout Joint Venture to create a comprehensive database of existing trout populations.
   c. Define wild trout stream segments versus stocked stream segments.
   d. Collect native trout population data to determine downstream extent of native populations.

Diversification of Stocked Trout Fishing Opportunities

ISSUES

West Virginia trout stockings are traditionally a spring event apart from two weeks in October in some of our mountain areas. The trout program emphasizes healthy fish and stocking opportunities across the State. More recently the Gold Rush program was developed to create an interest in trout fishing in conjunction with popular State Park vacation locations. The Fisheries Program collaborates with the Law Enforcement Program to provide protection for the resource and its workers during stockings. West Virginia trout anglers indicate a need for a more diverse management opportunity with an emphasis on fingerling growth for a wild trout experience. Diversified management opportunities and programs are desired to be across the calendar year and should be different for stocked verse wild/native trout. Anglers would like to see more youth programs introduced within those programs. While announced trout stockings have been the norm, it appears that some anglers want to see less notification to avoid crowded areas and trout stocking truck followers. West Virginia anglers want resource protection and habitat improvement as part of the trout program. Anglers currently support efforts to improve and/or maintain suitable trout habitat.

VALUES

The West Virginia trout stocking program has numerous values to the anglers and communities throughout the state. The trout stocking program improves overall awareness of our state trout fishing resources, enhances economic values in local communities, and increases tourism. Some families use stocked trout angling as a family bonding event, especially during unique stocking events like the Gold Rush. Trout stocking provides a greater variety of fishing opportunity specially to underrepresented facets. The trout stocking program provides fish harvest opportunity, better overall harvest sustainably, and reduces the angling pressure on natural and wild stocks. The stocking program is also a great tool to recruit new angler and potentially create life-long stewards of our natural resources.

GOAL

Improve satisfaction of stocked trout anglers through a diversity of experiences to maintain and increase participation.

OBJECTIVES AND STRATEGIES

1. Expand trout fishing opportunities beginning in 2023 by diversifying the frequency and location of trout stocking and extending the stocking season.
   a. Conduct one or more trout stocking events during the month of December in at least 10 lakes each year.
   b. Establish new trout stocking locations on larger streams and reduce stocking on smaller streams to improve angler access and increase the surface area of fishable trout waters.
   c. Assess public support for developing a single-day license for fee fishing lakes.
   d. Enhance wild trout fisheries through additional fingerling trout stockings within biological constraints, including genetic integrity, water quality, and conservation of endangered and threatened species.
   e. Conduct creel surveys at a minimum of every five years to evaluate angler satisfaction, catch rates, and demographics.
2. Request delayed-harvest regulations through the Natural Resources Commission to be completed by 2025 that will diversify stocked trout fishing by seasonally using catch-and-release and harvest regulations.
   a. Convert at least three (3) existing catch-and-releases waters to delayed-harvest regulations where environmental conditions are not capable of sustaining year-round trout populations.
   b. Create delayed-harvest regulations for at least 10 additional streams throughout the state.
   c. Create at least one (1) delayed-harvest lake in each of the six WVDNR management districts.
   d. Recommend an early "harvest" season on delayed-harvest impoundments for youth anglers.
   e. Conduct creel surveys at a minimum of every five years to evaluate angler satisfaction, catch rates, and demographics.
3. Diversify the mix of trout species stocked within each WVDNR district beginning in 2023.
   a. Evaluate hatchery program capacity and modify logistics accordingly to facilitate the production and stocking of a greater mix of trout species.
   b. Stock a greater mix of trout species during individual stocking events.
   c. Conduct angler creel surveys at a minimum of every five years to evaluate angler satisfaction, catch rates, and demographic information.

Diversification of Stocked Trout Fishing Opportunities continued

4. Diversify when stockings are pre-announced and reported.
   a. WVDNR will continue unannounced stocking events for lakes and streams on a statewide basis. Daily stockings will be posted on the WVDNR trout stocking webpage by 4:00 pm daily.
   b. WVDNR will announce trout stockings 30 days prior to stocking for at least 10 streams or lakes stocked with catchable-size trout from March through May. This allows anglers to plan accordingly by shifting the stocking announcement from the afternoon of stocking to one month prior to stocking.
   c. WVDNR will establish delayed-harvest waters as a catch-and-release regulation until April 30 each year. Delayed-harvest streams and lakes will be available for harvest starting May 1, providing an "opening day" experience.
   d. Conduct angler creel surveys at a minimum of every five years to evaluate angler satisfaction, catch rates, and demographic information.

Enhancing Native and Wild Trout Fisheries

ISSUES

Native and wild trout provide popular fisheries throughout West Virginia. Consequently, many anglers are concerned with the status, management, and angler use of these fisheries. Those who manage and fish for wild trout believe that there should be more and healthier wild trout populations in the state and that more emphasis must be placed on protection and management. Resource managers and trout anglers alike need to better understand the status of wild trout populations and management options to respond to the threats they face, such as climate change, habitat reduction, acid precipitation, and over-harvesting. How temperature and hydrology fluctuate because of changing climatic conditions need to be better understood in order to improve wild trout management. Additionally, aquatic habitats in many streams that support wild trout or could support them have been degraded by historical land use. Finally, in some locations excessive harvest, especially of Brook Trout, may be a factor suppressing wild trout populations. With enhanced management of this valuable fishery and with proper attention to managing angler use, West Virginia can take advantage of that momentum, with benefits to the fishery, the people who enjoy it, and our recreational economy.

VALUES

Trout anglers value sustainable and healthy wild and native trout fisheries. Wild and native trout are beautiful fish that live in beautiful places. Wild and native trout inspire a sense of adventure, increase contact with the outdoors, instill an attachment to streams, and invoke pride in their protection. They are destination fisheries that attract and retain anglers, thus benefitting local economies. These fisheries require clean water and quality habitat. Brook Trout, in particular, are representative of the health of headwater streams. Maintaining, enhancing, and restoring habitat quality and reconnecting headwater trout populations benefit not only Brook Trout and the anglers that fish for them there, but downstream fisheries and those anglers who fish there as well. To that end, public agencies, other conservation organizations, and all anglers should promote and ensure the conservation of all waters sustaining wild and native trout for the array of benefits that they provide. Effective angling regulations and protection of water and habitat quality are key values. Honoring all these values will require a broader public connection to these treasured resources.

GOALS

Enhance native and wild trout populations in West Virginia and develop deeper public connections to the resource. Improve scientific knowledge of native trout populations and their habitats.

Enhancing Native and Wild Trout Fisheries continued

OBJECTIVES AND STRATEGIES

1. Refine and publish known native Brook Trout and wild trout distribution and status on public land as part of the online Fishing Map by March 31, 2024, and continue to refine and update annually by March 31.
   a. Prioritize filling data gaps in annual stream survey plans.
   b. Establish appropriate scale of data for public dissemination.
   c. Continue engagement of partners to aid in data collection and validation of trout waters.
   d. Periodically reassess waters for changes in wild trout population status.
2. Complete a statewide genetic assessment of native Brook Trout by December 31, 2026.
   a. Employ annual stream survey efforts for genetic data collection.
   b. Increase scope of existing contract with Wild Genomics Lab at WVU for analysis.
   c. Integrate context of West Virginia's Ohio basin Brook Trout within the larger EBTJV range-wide genetic assessment.
3. Restore native Brook Trout to selected stream segments within a minimum of three (3) sub-watersheds (HUC12) by December 31, 2026.
   a. Prioritize and select areas for restoration based on stream survey efforts and EBTJV/TU Conservation Portfolio.
   b. Translocate trout into stream catchments where donor population genetics and functional structure will not be impacted.
   c. Use genetically appropriate heritage strains for all native Brook Trout restoration activities.
   d. Use field and hatchery spawning methods to develop fingerling heritage strains of Brook Trout when adequate donor populations are not adequate for translocation.
4. Assess streams across the range of wild and native trout for acid precipitation and climate change impacts beginning in 2022.
   a. Use paired air and water temperature loggers to collect hourly temperatures.
   b. Use calibrated staff gages to measure stream discharges.
   c. Data will be used to guide legislative, conservation, and management actions.
5. Implement a trout waters classification system to guide management to the "wildest" condition feasible by December 31, 2022.
   a. Historical, current, and planned stream survey data collection will determine classification.
   b. Use the West Virginia Trout Stream Management Classification outlined elsewhere in this Plan to determine current classification and appropriate management scheme for trout waters.
   c. Use the West Virginia Trout Wildness Spectrum described elsewhere in this Plan to define and explain values of "wildness" and to establish a desired condition for trout waters.
6. Conduct research to determine if stocking trout reduces the number and biomass of trout populations in three streams by December 31, 2026.
   a. Collect stream survey data on fisheries, water quality, and habitat annually.
   b. Modify stocking scheme on a minimum of three (3) areas occupied by quality native and/or wild trout populations.
   c. Resample streams to assess fisheries, water quality, and habitat to evaluate the effects of stocking.
   d. Use the West Virginia Trout Stream Classification and West Virginia Trout Wildness Spectrum to determine necessity and appropriateness of changing stocking schemes.
7. Propose a minimum of four (4) native or wild trout waters for gear and harvest regulations (e.g., creel limit, tackle, length restriction, etc.) by December 31, 2024.
   a. Identify additional pertinent criteria for determining candidate waters. Current guidelines include:
      - Large, contiguous, third-order or better, well-connected watershed,
      - Recent, active, or planned management activities to maintain or improve coldwater habitat and population,
      - Must have a supportive, but not necessarily majority, constituency,
      - Must NOT be part of regular seasonal stocking schedule,
      - Great majority of candidate trout water must be on public or cooperative partner land.
   b. Establish a plan to monitor outcomes of changes in regulations.

Education, Outreach and Communication

ISSUES

The WVDNR utilizes a variety of approaches to educate the public about trout fishing and management. Many of these programs are designed for youth and occur in schools. With the "trout in the classroom" program, WVDNR works with conservation partners and local schools to teach students about trout biology, water quality, stream habitat, conservation ethics and ecosystem balance. However, other programs that can educate individuals in trout fishing, conservation, and management are needed to reach a broader audience and increase interest and participation.

The WVDNR partners with other agencies, communities, and schools to conduct outreach events to introduce people to fishing. These outreach programs include the National Hunting and Fishing Day Celebration and fishing derbies at state parks. Recently, the WVDNR initiated the "Gold Rush" stocking program to encourage families to fish together. However, participation in some outreach programs has declined. Additionally, the average age of a trout angler is 57 and more than 90% are male. Therefore, existing education and outreach programs may be insufficient at diversifying the individuals who trout fish.

The future of trout management in West Virginia relies on strong two-way communication between WVDNR and the public. Individuals can communicate with WVDNR staff regarding trout fishing and management by attending public meetings or contacting staff directly. Conversely, WVDNR relies on the agency website and social media platforms to relay information regarding trout fishing and management. Website and social media users would like to see information expanded. However, stakeholders who do not utilize technology have difficulty finding and sharing information on trout fishing.

VALUES

Educating the public and especially youth about natural resources and trout management is critical in making long-term stewards of West Virginia's natural resources. Education on fishing and aquatic environments can inform the public about fish and wildlife regulations, how each of us can protect valued resources, and improve communication between the public and management agencies. The WVDNR has platforms to provide valuable scientific-based information to educate stakeholders about fish and wildlife management and conservation.

Outreach opportunities are essential in developing angler awareness for adults, children, and minority users. Outreach events also provide personal connections between the WVDNR and potential anglers and could increase overall angler diversity. Aquatic conservation events provide valuable opportunities for novice anglers to become familiar with a variety of fishing equipment and techniques. New anglers can also be familiarized with ethical angling values and develop a sense of pride for the state's aquatic resources.

Effective trout management requires effective communication between the WVDNR and stakeholders. Good communication can remove barriers, reach a broader audience, promote public knowledge of fisheries science, and increase understanding of science-based regulations. The effective use of education, outreach, and communication opportunities are crucial in creating conservation stewardship, ethical anglers, and setting outdoor enthusiast up for success.

GOALS

Cultivate a broad public connection to coldwater fisheries resources and conservation issues and efforts. Support and educate existing and future anglers on trout fishing opportunities and retain those that already participate.

Education, Outreach and Communication continued

OBJECTIVES AND STRATEGIES

1. Increase youth and young adult participation in trout fishing by 10% by December 31, 2026.
   a. Develop a comprehensive marketing plan to promote trout fishing derbies and follow-up communication with participants.
   b. Develop and institute angler education and "how to" fishing classes and video content targeted at youth and young adult beginning anglers.
   c. Host at least one fishing derby per year in each DNR district, with a focus on State Parks with loner gear programs and parental tutorial availability.
   d. Partner with trout-oriented conservation groups, such as TU, Izaak Walton League, Scouting, and Wounded Warrior to develop and cross-promote youth mentoring programs for trout fishing.
   e. Partner with existing youth groups (Boys and Girls Scouts, 4H, summer camps, etc.) to incorporate a trout fishing component to their camp or events. Develop a volunteer mentor network to host group tutorials for trout fishing and conservation.
   f. Provide information on how to initiate and manage trout fishing clubs and organizations at schools and universities.
   g. Host "family trout fishing" events in state parks with loan-a-gear program and tutorial for beginning anglers/parents.
   h. Create a "Buddy License" rewards program geared toward high school- and college-age anglers that encourages their friend(s) to buy a license and take them fishing.
   i. Develop family-friendly angling events that encourage parents or guardians to bring their children.
   j. Initiate and evaluate regularly scheduled surveys to measure and evaluate program effectiveness.
   k. Implement a registration system to monitor the number of new and returning participants in annual fishing derbies. This system should be connected to the ELS Database if possible.
   l. Measure the effectiveness of partner fishing events by evaluating license buying patterns of participants (ages 15 and above) through monitoring DNR ID number in the ELS System.
   m. Develop and implement a lapsed angler survey assessing the cause of angler churn in young adults (18-25).
2. Increase participation of women in trout fishing by 10% by December 31, 2026.
   a. Ensure women are well represented in promotional, educational, and social media materials.
   b. Develop and implement women-specific focus groups related to participation in trout fishing.
   c. Develop and institute angler education and "how to" fishing classes targeted at beginning and intermediate female anglers.
   d. Work with partner organizations to host workshops designed specifically for beginner women anglers that focus on trout fishing or fly fishing for them and their families (e.g., Becoming an Outdoors Woman).
   e. Partner with WV State Parks to hold women's fishing weekends, focusing on parks that have loner gear and are easily accessible.
   f. Develop and conduct regularly scheduled surveys to evaluate program effectiveness.
   g. Implement required ELS registration at Becoming an Outdoors Woman classes and other related events to track participation.
3. Increase participation of racial and ethnic minorities in trout fishing by 10% by December 31, 2026.
   a. Ensure minorities are well represented in promotional, educational, and social media materials.
   b. Develop and implement minority-specific focus groups related to participation in trout fishing activities.
   c. Develop and institute angler education and "how to" fishing classes and video content targeted at beginning and intermediate minority anglers.
   d. Host demonstrations and tutorials at sporting goods stores or outdoor retailers located near minority communities.
   e. Promote urban fishing opportunities closer to minority communities.
   f. Collaborate with minority initiatives and organizations (e.g., Herbert Henderson Office of Minority Affairs) to promote trout fishing events.
   g. Partner with university minority programs and groups (e.g., Marshall University Minority Health Institute, WVU Division of Diversity, Equity and Inclusion, etc.) to promote trout fishing events.
   h. Develop and conduct regularly scheduled surveys to evaluate program effectiveness.
   i. Implement required ELS registration at trout related events to track participation and license trends.

Education, Outreach and Communication continued

4. Increase trout-related content on DNR managed media platforms by 20% by December 31, 2026
   a. Connect media platforms and partners through cross promotion of marketing and communications materials that support trout fishing and other related activities.
   b. Plan content calendar for organic social media efforts that is focused on trout-related content, especially during fall and spring trout stocking seasons.
   c. Increase followers of DNR social media channels through proven promotional efforts.
   d. Promote trout-related content on the new WVDNR website to increase knowledge and awareness of trout fishing opportunities and events.
   e. Develop and promote the Ethical Angler platform.
   f. Use print media to promote trout management (e.g., Wonderful WV Magazine, Newspapers, etc.)
   g. Complete and update all District Fishing Guides with current information regarding trout stocking schedules and fishable waters.
   h. Develop and implement email marketing campaigns focused on increase fishing license and trout stamp sales, while driving traffic to DNR website and social media channels.
   i. Partner with Ernie Nester Chapter of TU to subsidize, improve, publish, and promote their periodic Guide to the Catch-And-Release Trout Streams of WV.
   j. Utilize cross-promotion opportunities with stakeholder groups.
   k. Compare and measure new website traffic and website usability.
   l. Monitor social media metrics through post reach, engagement and click rates.
   m. Review email marketing key performance indicators to evaluate campaigns.
5. Conduct a trout-related survey by December 31, 2026, and at least once every 5 years thereafter, to gauge and evaluate public interest in trout management.
   a. Use license data and partnerships with external organizations to conduct surveys.
   b. Conduct a trout angler survey in 2022 to estimate participation and attributes of target demographics youth, women, and minorities. This will be necessary to establish a baseline for quantifying progress toward 2026 objectives.
   c. Work with a human dimensions or research specialist to conduct focus groups to determine participant interest and attitudes toward trout management.
6. Increase direct engagement youth educational opportunities for trout and coldwater conservation by 15%.
   a. Develop messaging to promote the role of trout anglers as conservationists.
   b. Utilize partnerships to highlight successful youth trout-focused programs.
   c. Incorporate trout conservation into existing nature and outdoor education events where it is currently absent or underrepresented.
   d. Incorporate trout conservation programs and presentations into existing non-nature/outdoor events. (sporting events, fairs and festivals)
   e. Increase coldwater conservation events (e.g., riparian planting, cleanup competitions, putting up signage, photo contests, fly-tying derbies, etc.).
   f. Increase training and use of Project WILD and Aquatic WILD K-12 supplemental curriculum in WV.
   g. Partner with WV DEP programs, Project WET and Save our Streams.
   h. Create a turnkey package for educators to provide to students about trout fishing, management and conservation. Partner with Boards of Education to integrate in existing curriculum.
   i. Expand the USFS river snorkeling program to other partners and locations and use it as a platform for meeting other objectives in the plan.
   j. Develop mentorship program, materials, and guidance for mentors and youth participants.
   k. Determine a standard practice to track youth participants.
   l. When youth become of age, track license and trout stamp buying patterns each year.

Education, Outreach and Communication continued

7. Increase adult outreach opportunities for trout and coldwater conservation by 10%.
    a. Develop and promote the Ethical Angler platform.
    b. Create promotional materials regarding successful trout management practices.
    c. Incorporate trout conservation into existing nature and outdoor education events where it is currently absent or underrepresented.
    d. Incorporate trout conservation programs and presentations into existing non-nature/outdoor events. (sporting events, fairs and festivals)
    e. Host women's only workshops for trout fishing tutorials for women and their families.
    f. Work with stakeholders to cross-promote educational opportunities for adults.
    g. Increase volunteer opportunities for the public to work on trout and coldwater conservation projects.
    h. Develop mentorship program, materials, and guidance for mentors and adult participants.
    i. Determine a standard practice to track participants through the ELS system or another methodology.
8. Develop and implement four (4) trout fishing promotions by December 31, 2026.
    a. Promote a tagging program for stocked trout where any angler who catch a tagged fish can learn more about where that fish came from, when it was stocked, etc.
    b. Utilize partnership with West Virginia State Parks to enhance fishing promotions.
    c. Develop trout fishing awards, such as stickers, badges, and plaques to recognize achievements. Work with area outfitters to supply "grand prize" type items like a fly rod or tackle.
    d. Establish and promote a Native and Wild Trout Conservation Trail, WV Highlands Catch and Release Trail, WV Wild Trout Fly Fishing Trail, and WV State Parks Trout Fishing Trail.
    e. Initiate a "Citizen Science" angling logbook – voluntary angler catch reporting – with preferred invite to an annual meeting/conference to present and discuss previous year's angling logbook results.
    f. Work with area outfitters to provide a beginning fishing pamphlet with starter fishing kits.
    g. Create trout fishing awards (e.g., catch each species, catch Brook Trout in multiple watersheds, master angler, lifetime achievements, etc.)

Table 11.

Priority Ranking of West Virginia Trout Management Plan objectives by Stakeholder Advisory Committee (SAC) and the Technical Advisory Committee (TAC). Lower numbers are considered more important.

Priority Level		Trout Management Plan Objectives
SAC	TAC	
		FUNDING, INVESTMENT, AND CAPACITY
3	1	Conduct a financial evaluation of current WVDNR trout management activities by December 31, 2022.
4	3	Identify additional funding sources for programs and activities that will enhance recreational trout fishing opportunities by July 1, 2023.
2	4	Develop 25 partnerships with private landowners, local entities, municipalities, industries, conservation partners, and public groups that support long-term investments in stocked trout management or help sustain wild/native trout management by July 1, 2026.
1	2	Identify expenses required to enhance stocked and wild/native trout programs by December 31, 2023.
4	2	Develop a financial plan and balance sheet that projects operational costs to support the trout management program by December 31, 2023.
		DIVERSIFYING AND ENHANCING PUBLIC FISHING ACCESS
2	3	Increase the number of trout stocking access points by 10% percent (200 additional locations) by January 1, 2026. The WVDNR currently stocks trout at approximately 2,000 different access points across the state.
3	2	Improve the quality of current public access points by providing facilities for families, youth anglers, and disabled anglers beginning in 2023.
1	1	Create partnerships with public and private entities to expand angling access and improve facilities for coldwater resources starting December 31, 2021.
4	4	Provide access to documents that describe the legal rights for stream access on private land by January 1, 2023.
		HABITAT
1	2	Protect 25 stream segments with existing high-quality trout habitat by December 31, 2026, at risk of future degradation.
4	3	Enhance or restore 30 miles of in-stream physical habitat by December 31, 2026.
2	1	Maintain 300 miles and improve 50 miles of water quality to support trout populations in streams by December 31, 2026.
3	4	Increase connectivity by restoring fish passage at 25 crossings by December 31, 2026.
		ECOLOGICAL HEALTH AND RISKS
2	3	Establish monitoring programs on ecological threats that affect water quality, habitat, and climate change across West Virginia by December 31, 2023.
5	2	Implement fish health monitoring programs for hatchery and wild trout by December 31, 2023.
4	5	Develop a program to monitor the genetic integrity of wild and stocked populations by December 31, 2023.
1	1	Establish a public outreach program on the ecological risks to trout populations (e.g., moving fish, water quality, habitat impairment, exotic species, etc.) by December 31, 2022.
3	4	Develop a database to store, analyze, and share trout data by December 31, 2024.
		DIVERSIFICATION OF STOCKED TROUT FISHING OPPORTUNITIES
2	2	Expand trout fishing opportunities beginning in 2023 by diversifying the frequency and location of trout stocking and extending the stocking season.
1	1	Request delayed harvest regulations through the Natural Resources Commission to be completed by 2025 that will diversify stocked trout fishing by seasonally using catch-and-release and harvest regulations.
4	4	Diversify the mix of trout species stocked within each WVDNR district beginning in 2023.
3	3	Diversify when stockings are announced including streams and lakes where stockings are unannounced, announced 30 days in advance, and a delayed announcement

Table 11 continued.

Priority Level		Trout Management Plan Objectives
SAC	TAC	
		ENHANCING NATIVE AND WILD TROUT FISHERIES
6	5	Refine and publish known native Brook Trout and wild trout distribution and status on public land as part of the online Fishing Map by March 31, 2024 and continue to refine and update annually by March 31.
7	6	Complete a statewide genetic assessment of native Brook Trout by December 31, 2026.
1	2	Restore native Brook Trout to selected stream segments within a minimum of three (3) sub-watersheds (HUC12) by December 31, 2026.
2	3	Establish monitoring stations at twelve (12) sites over the range of native and wild trout in West Virginia to assess the impacts of acid rain and climate change (e.g., stream and air temperatures, stream flows, drought, flooding, etc.) on wild trout communities by December 31, 2024.
5	1	Implement a trout waters classification system to guide management to the "wildest" condition feasible by December 31, 2022.
3	7	Conduct research to determine if stocking trout reduces the number and biomass of trout populations in three streams by December 31, 2026.
4	4	Identify a minimum of four (4) native or wild trout waters for gear and harvest regulations (e.g., creel limit, tackle, length restriction, etc.) by December 31, 2024.
		EDUCATION, OUTREACH AND COMMUNICATION
2	1	Increase youth and young adult participation in trout fishing by 10% by December 31, 2026.
6	3	Increase participation of women in trout fishing by 10% by December 31, 2026.
4	5	Increase participation of racial and ethnic minorities in trout fishing by 10% by December 31, 2026.
3	4	Increase trout-related content on DNR managed media platforms by 20% by December 31, 2026.
6	7	Conduct a trout-related survey by December 31, 2026, and at least one every 5 years thereafter to gauge and evaluate public interest in trout management.
1	2	Increase direct engagement youth educational opportunities for trout and coldwater conservation by 15%.
5	7	Increase adult outreach opportunities for trout and coldwater conservation by 10%.
6	6	Develop and implement four (4) trout fishing promotions by December 31, 2026.

ADVISORY COMMITTEES

Table 12.

Stakeholder Advisory Committee (SAC) members.

Devin Bokey	Angler / Social Media Monitor
Brianna Casey	Angler / Social Media Monitor
Autumn Crowe	West Virginia River Coalition
Gene Cunningham	Angler
Perry Harvey	Buffalo Creek Watershed Association
Matt Higgins	Retail sporting goods merchant
Steve Hite	Angler
Larry Orr	Trout Unlimited - Grassroots Member
Zach Pittman	Angler / Social Media Monitor
Jason Walls	Managing Attorney – Land Use and Sustainable Development
Carol Webb	Vocational Agriculture Teacher
Dustin Wichterman	Trout Unlimited - Mid Atlantic Cold Water Habitat Program Associate Director

Table 13.

Technical Advisory Committee (TAC) members.

David Thorne	WVDNR – Coldwater Biologist
Callie McMunigal	USFWS – Fish Habitat Partnership Coordinator
Jeff Hansbarger	WVDNR – Fisheries Biologist
Samuel England	WVDNR – WV State Parks Chief (Retired)
Frank Williams	WVDNR – Hatchery Program Biologist
Eric Hevener	WVDNR – Spring Run Hatchery
David Trader	WVDNR – Lieutenant Colonel, Natural Resources Police
Randy Tucker	WVDNR – Wildlife Biometrics (Retired)
Scott Mandirola	WVDEP – Deputy Secretary
Chad Landress	USFS – Fisheries Biologist
Steve Brown	WVDNR – Contractual
Mike Owens	USFS – Aquatic Ecologist
Brandon Keplinger	WVDNR – Fisheries Biologist
Jim Hedrick	WVDNR – Hatchery Program Manager
Vic DiCenzo	WVDNR – Human Dimensions Specialist

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