Beaver Creek Fish Kill (August 7 - 8, 2023) and Investigations

Introduction

Beaver Creek is one of the largest limestone streams in Maryland. Originating as a freestone stream on the west slope of South Mountain, the majority of the flow during the summer months is influenced by the numerous springs in the Hagerstown Valley. The largest spring (~3,400 gallons per minute) influencing Beaver Creek is used as the water supply for the Albert Powell State Trout Hatchery, which rears adult and juvenile rainbow trout (*Oncorhynchus mykiss*) for stocking into Maryland streams. Upstream of the spring's influence, Beaver Creek is considered a warm-water stream and flows underground much of the year due to local Karst geology. Intensive agricultural operations (dairy and row crop) within the Hagerstown Valley have severely impacted Beaver Creek throughout its length. Various stream improvement projects have been completed on the mainstem and tributaries to correct harmful effects of improper land management practices and to improve instream trout habitat.

The springs that influence Beaver Creek maintain stable stream flows and cold water temperatures year round below the Albert Powell State Fish Hatchery. These habitat conditions have supported a high density, wild brown trout (*Salmo trutta*) population that includes trophy caliber fish. The population is entirely self-sustained through natural reproduction. Benthic macroinvertebrates, particularly crustaceans, are highly abundant and provide a consistent forage base that supports trout growth to all size classes. The abundance of wild, fast growing trout in a unique spring creek environment led to Beaver Creek becoming a destination fishery for trout anglers. A one mile stretch of Beaver Creek downstream of the confluence with Black Rock Creek was designated as a Fly-Fishing-Only, Catch-and-Return Trout Fishing Area in 2004. To secure public fishing access to this unique wild trout resource, the department purchased property from the Charles Jackson family to create the Beaver Creek- Jackson Fish Management Area.

Fish Kill

During the afternoon and evening of August 7, 2023, a major storm event occurred that produced heavy downpours and significant hail. Localized rainfall amounts were near three inches within

Figure 1. Dead trophy Beaver Creek wild brown trout, August 8, 2023.

an hour quickly raising the stream to bankfull levels and increasing turbidity. Freshwater Fisheries and Hatcheries Division (FFHD) staff arrived at Beaver Creek on the morning of August 8 to conduct an annual trout population survey. Around 9:00 am as staff prepared to conduct the first survey within the Beaver Creek-Jackson Fish Management Area, staff began to observe dead trout (brown and rainbow trout) along the shore and on the stream bottom. The survey was halted to investigate the fish kill.

FFHD staff counted 40 dead trout in the next 100 meters of the stream, then promptly notified the Maryland Department of Environment (MDE) Fish Kill Investigation Program. MDE staff from Fish Kill Investigations and Compliance Program Inspectors responded to Beaver Creek to assist with the investigation. Most of the observed mortality were adult brown trout, though young-of-year trout and nongame species (white sucker and sculpin) were also observed. Basic water quality data, typically recorded during routine fish surveys, were taken and were consistent with previous values (Table 1).

Table 1. Basic Beaver Creek water quality recorded within the Beaver Creek/Jackson FMA on August 8, 2023 using a Yellow Springs Instruments meter.

Parameter	**Value**
Water Temperature	16.2 degrees Celsius (61.1 degrees Fahrenheit)
Dissolved Oxygen Saturation	72.8 percent
Dissolved Oxygen	7.15 milligrams per liter
Specific Conductance	479.6 microSiemens per centimeter
pH	7.62

Initial Investigations

FFHD staff then began to check additional stretches of Beaver Creek and Black Rock Creek for the presence of dead and dying fish on August 8. Dead trout were observed from Route 40 upstream to the Spring Channel at the upstream side of the Route 70 interchange overpasses. One dead trout but no other fish species were observed in the Beaver Creek mainstem upstream of that point, the Spring Channel, or at the Albert Powell Trout Hatchery. Due to the elevated flows and turbidity generated by the storm runoff, it was not possible to ascertain the degree of fish loss since many fish would have already been washed downstream the previous night.

To gain insight into the degree of fish loss and survival, FFHD staff conducted qualitative assessments with electrofishing equipment at three locations on August 8. Although dead trout were observed at Route 40 (Figure 1), electrofishing efforts quickly documented a number of surviving trout of multiple year classes at that location. A similar effort in Black Rock Creek from its confluence with Beaver Creek upstream to the Beaver Creek Fly Shop found no dead fish, multiple year classes of brown trout, and normal densities of nongame fish species. The final assessment

was made in the Beaver Creek mainstem from the fly shop upstream to the Spring Channel confluence above Route 70. No live trout were found until the confluence of the Spring Channel and “Junction Pool” where several adult brown trout and an adult rainbow trout were observed.

FFHD staff collected 10 recently deceased adult brown trout from the Beaver Creek-Jackson FMA, put them on ice, and transferred them to department fish health staff from the Oxford Cooperative Laboratory. Oxford Cooperative Laboratory staff were already at Albert Powell State Trout Hatchery to collect hatchery samples for routine fish health testing. Necropsies of these fish were completed on August 9 and no evidence of infectious disease or any other lesions were detected. MDE Water and Science Administrationstaff also retained tissue samples from dead trout for contaminant and histology analysis and collected water samples at several locations. Histology of those trout samples are being analyzed by the U.S. Geological Survey Fish Health Laboratory in Leetown, West Virginia.

A temperature logger that was deployed by FFHD within the Beaver Creek-Jackson FMA to monitor summer water temperatures was retrieved on August 10. Beaver Creek water temperatures were favorable for trout throughout the period of June 1 through August 10, with a maximum daily temperature below 20 degrees Celsius (68 degrees Fahrenheit; Figure 3).
A four degree decrease in temperature was associated with the August 8 runoff event (Figure 4) but temperatures remained within a range considered to be suitable for trout. These data suggest that stream temperatures are not a causative factor in the fish kill.

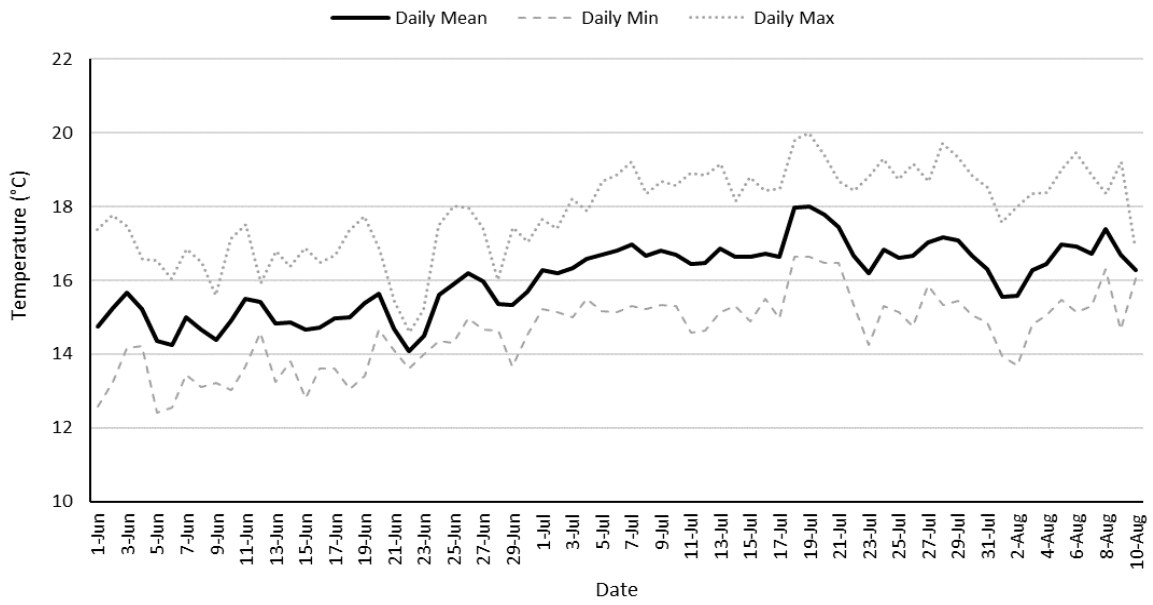

Figure 3. Daily mean, minimum, and maximum temperatures recorded in Beaver Creek June 1 - August 10, 2023.

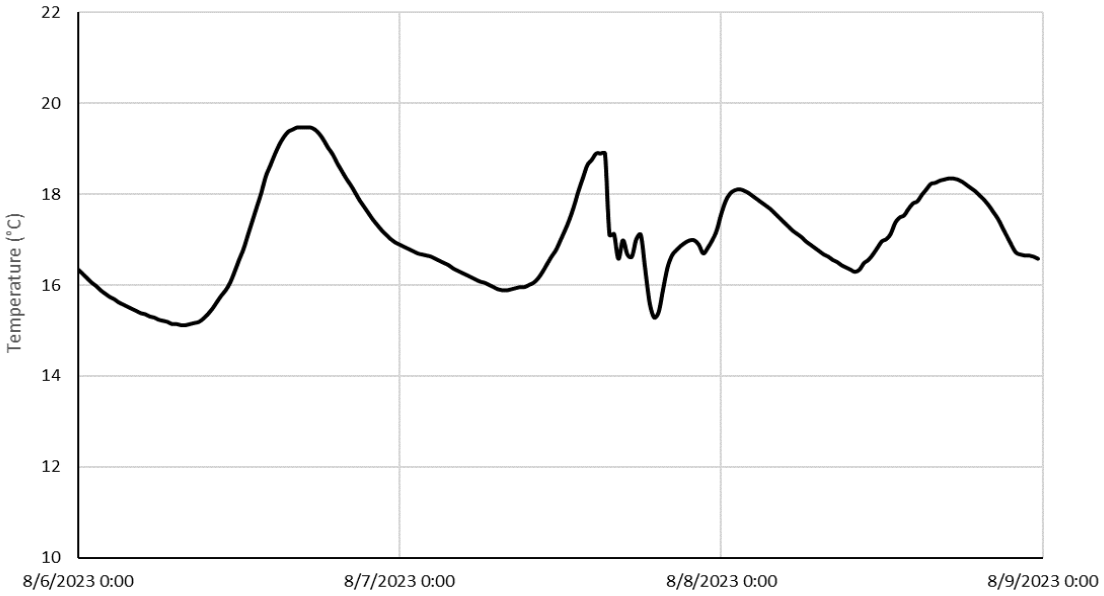

Figure 4. Beaver Creek stream temperatures recorded every 20 minutes within the Beaver Creek-Jackson FMA before, during, and after the fish kill.

Post Event Electrofishing Surveys

Quantitative electrofishing surveys were conducted on August 15 at five established survey sites (Figure 5) to observe impacts to the brown trout population resulting from the fish kill event. The names of the survey sites and their respective distance downstream of Interstate 70 are provided in Table 2.

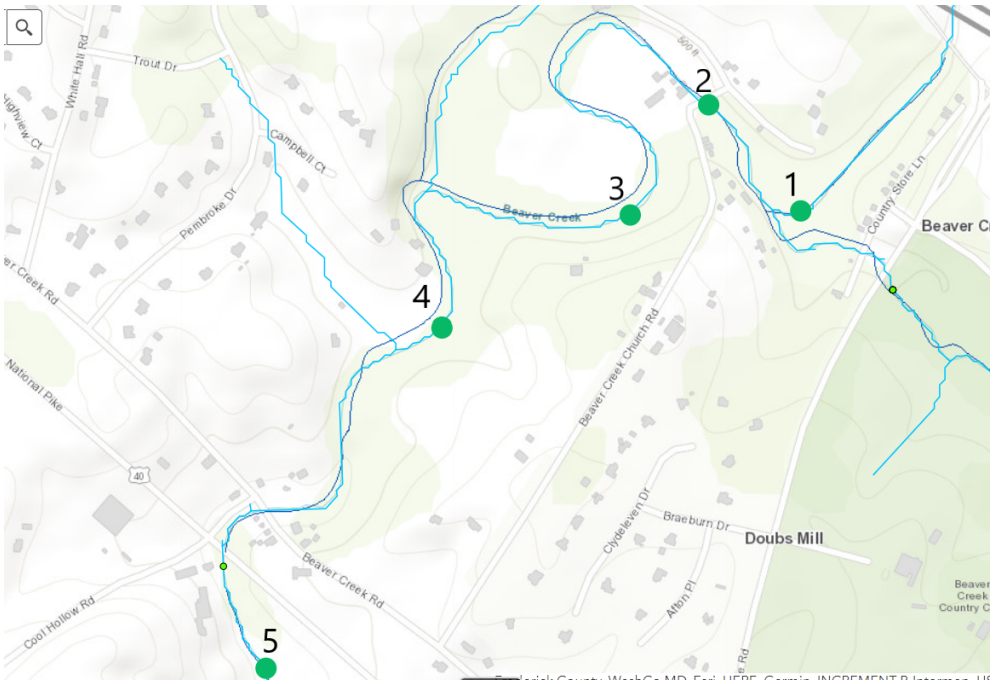

Figure 5. Beaver Creek trout survey sites for quantitative electrofishing surveys.

Table 2. Survey site names and downstream distance from I-70.

Station name	Distance downstream from I-70 (miles)	Map point number
Put-and-Take	0.30	1
Upper Jackson	0.48	2
Lower Jackson	0.93	3
Zimmerman	1.31	4
Rt 40	1.88	5

The electrofishing effort at Site 1 - Put-and-Take encountered no trout within the 123 meter (135 yard) site, suggesting a complete loss of the trout fishery at this location (Figure 6). Historically, this site has had the highest densities of adult and young-of-year brown trout of all survey sites on Beaver Creek. At Site 2 - Upper Jackson, several live adult brown trout were encountered, though no young-of-year trout were observed or collected (Figure 7). At Site 3 - Lower Jackson, nearly a mile downstream of Interstate 70, both adult and young-of-year trout were collected,

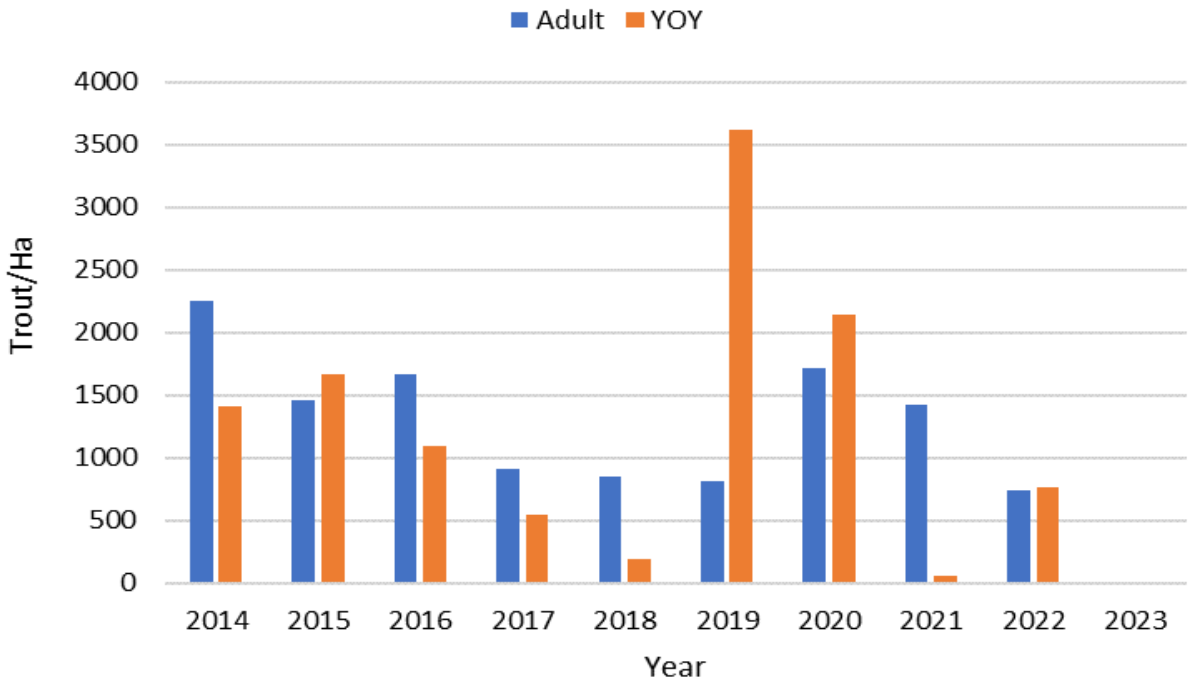

Figure 6. Brown trout population trends at Site 1 - Put and Take (2014-2023). No trout collected during the August 2023 survey.

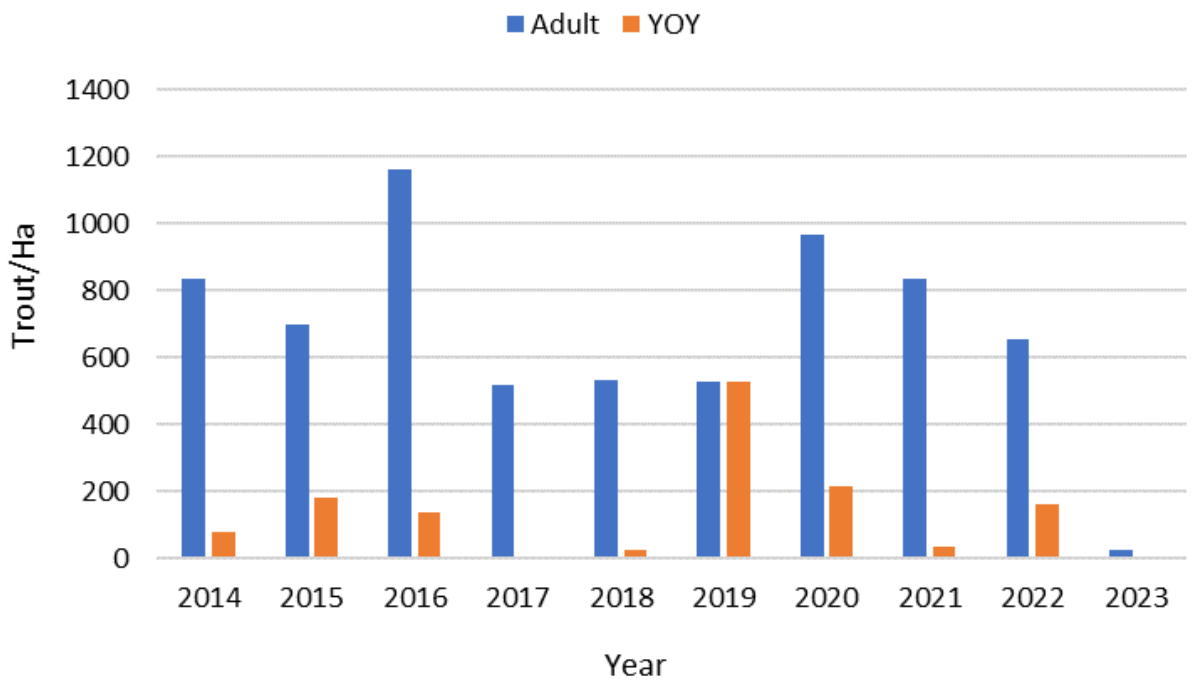

Figure 7. Brown trout population trends at Site 2 - Upper Jackson (2014-2023).

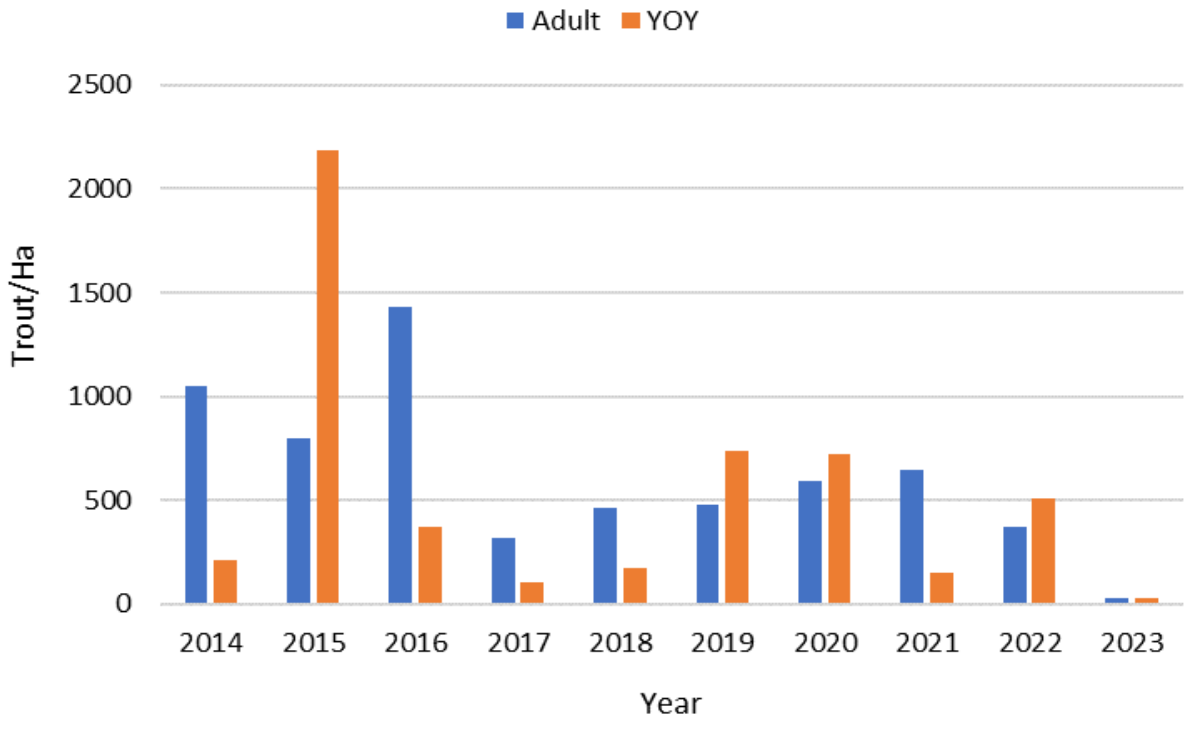

Figure 8. Brown trout population trends at Site 3 - Lower Jackson (2014-2023).

approximately 1.31 miles downstream of Interstate 70, adult and young-of-year brown trout begin to approach historic levels (Figures 9 and 10).

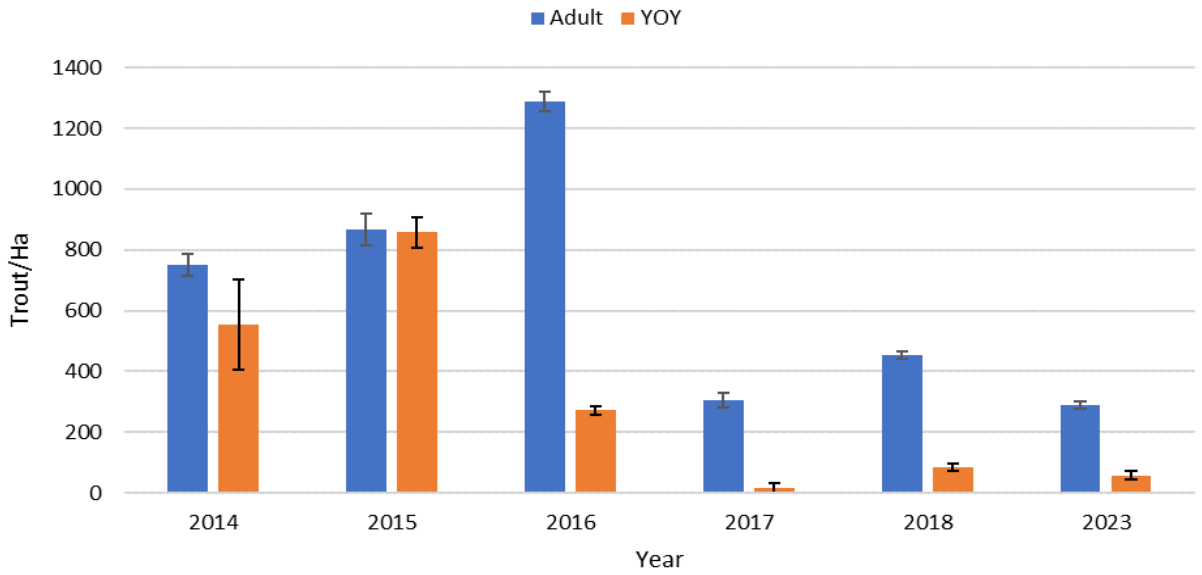

Figure 9. Brown trout population trends at Site 4 - Zimmerman. Error bars are 95 percent confidence intervals.

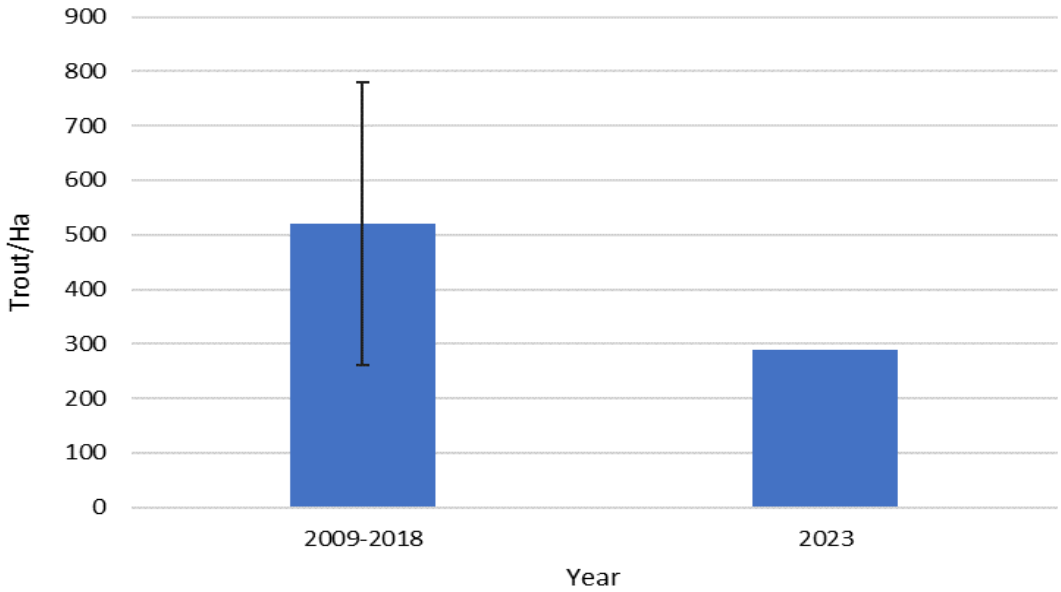

Figure 10. Mean brown trout population estimates (2009-2018) compared to 2023 post fish kill estimates at Site 4 - Zimmerman. Error bars represent the 95% confidence interval for mean adult brown abundance.

Brown trout population estimates for adult and young-of-year trout at Site 5 - Route 40 were considered to be comparable to the previous survey conducted in 2014 (Figure 11). Young-of-year and yearling brown trout were abundant. The lower numbers of adult trout collected were attributed to changes in the physical habitat within the 75 meter (246 feet) sample site that were less favorable for adult trout.

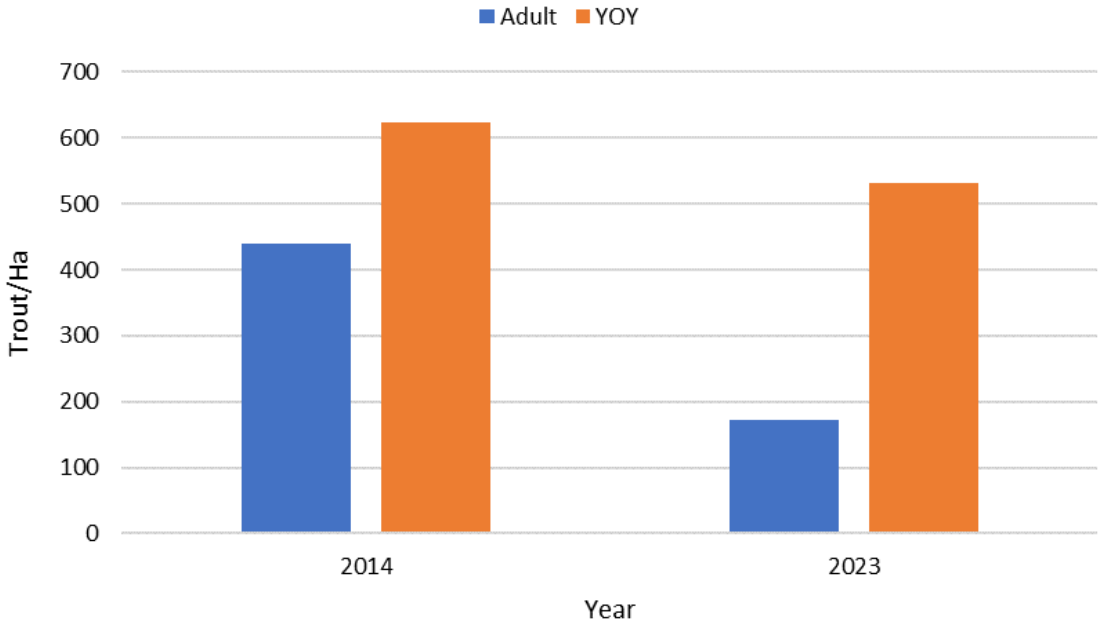

Figure 11. Comparison of adult and young-of-year brown trout relative abundance at Site 5 - Route 40 collected in 2014 and 2023 post fish kill.

The results of the quantitative electrofishing surveys suggested that the greatest impact to the Beaver Creek brown trout population was in close proximity to Interstate 70, where a total loss of the trout fishery occurred. Severe losses to the fishery were observed downstream in the Upper Put-and-Take and the Fly Fishing Only, Catch-and-Return Areas. Within the Fly Fishing Only, Catch-and-Return Area, biologists documented a 94 percent decline in the overall adult brown trout population (Figure 12). The impacts of the fish kill event decreased with downstream progression with identifiable impacts occurring approximately 1 to 1.3 miles downstream. There appeared to be no measurable impact to the wild brown trout population downstream of Route 40.

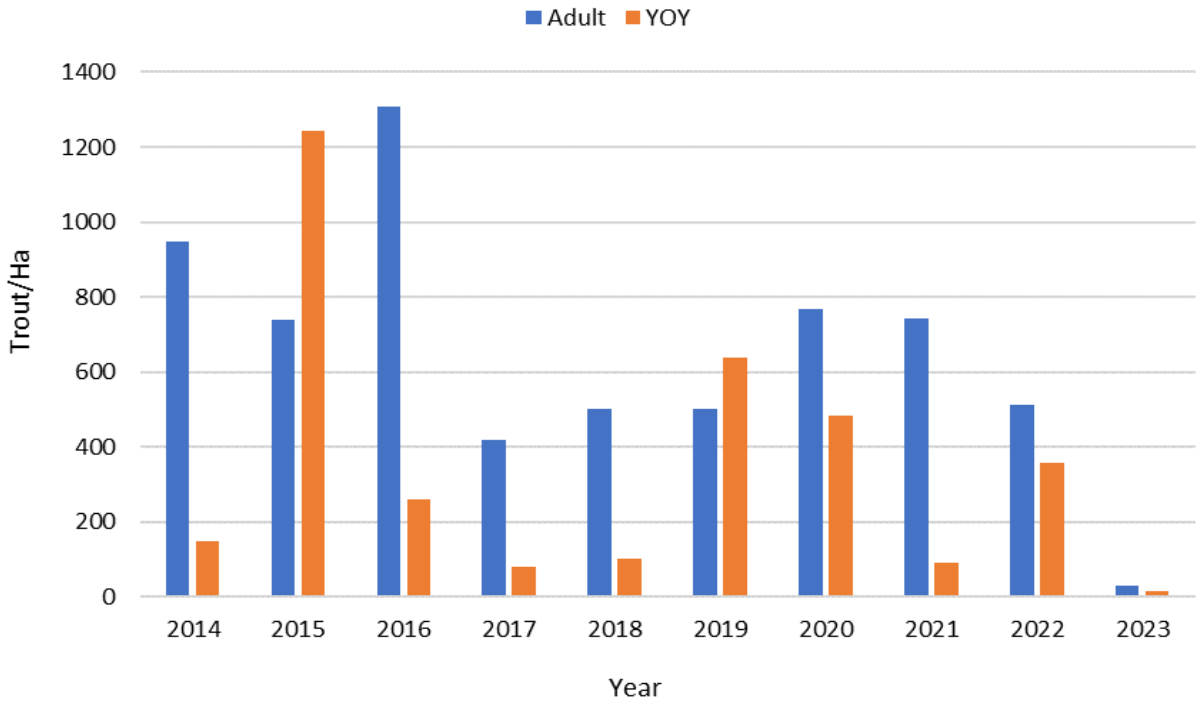

Figure 12. Brown trout population trends within the Fly Fishing Only, Catch and Return Trout Fishing Area (2014-2023); Upper and Lower Jackson Sites combined. Adult brown trout adult abundance in 2023 represents a 94.4% decrease from the 2022 adult population estimate.

FFHD staff measuring and weighing Beaver Creek brown trout at Site 4 - Zimmerman.

Maryland Department of Environment Investigations
MDE's Water and Science Administration, Compliance Program and Fish Kill Investigation Section, completed multiple inspections, interviews, and sampling efforts in response to this incident. Lab analysis of water quality on 8/8/23 showed no significant findings for parameters tested. This included nitrogen and phosphorus fractions, chlorinated pesticides, biological oxygen demand and chemical oxygen demand. Field measurements for temperature, dissolved oxygen, pH, and chlorine detected no problems for these parameters. Preserved trout were delivered to the USGS lab in Leetown WV for histological analysis. Results are not available at this time. Compliance inspections were conducted within the Beaver Creek drainage area, focusing on possible discharge locations. This included State Highway bridge repair work, a State Highway Administration Park and Ride Facility, the Beaver Creek Quarry, the Hetzer Asphalt Plant and the Albert Powell Hatchery wastewater discharge. Inspections did not determine any connection to the fish kill event. MDE coordinated with MDA and determined that no recent application of pesticides had occurred with the nearby drainage area.

Fishery Restoration Efforts
FFHD staff are taking steps to restore the wild brown trout fishery in a responsible manner as quickly as possible. Though some adult brown trout remain as source stock in the Beaver Creek mainstem within the Fly-Fishing-Only, Catch-and-Return Area as well as the Black Rock Creek tributary and Spring Channel, FFHD is proposing to collect a small number of mature adults from within the watershed and transplant them to the productive spawning habitat downstream of Interstate 70 prior to the fall 2023 spawning season. The most productive trout spawning and nursery habitat has historically been within the Put-and-Take Area near the fly shop. Source populations will not be significantly impacted by this action because only a small number of individuals will be selected for translocation.

To protect the remaining and transplanted brown trout within the Put-and-Take Area, Fishing and Boating Services scoped a regulatory idea to reduce the brown trout creel limit to zero; all brown trout caught from Beaver Creek from the Albert Powell Trout Hatchery downstream to the confluence with Antietam Creek would have to be immediately released. Public comment was overwhelmingly in favor of the measure. Together, these actions will help the fishery recover as quickly as possible using genetically appropriate, wild brown trout. FFHD will continue to monitor brown trout spawning activity during 2023 and adult and young-of-year stocks during the summer of 2024.

Healthy, adult wild brown trout from lower reaches of Beaver Creek.

If you have additional questions, please contact John Mullican (john.mullican@maryland.gov) or Michael Kashiwagi (michael.kashiwagi@maryland.gov).